THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. MAY 4, 1899. CHICAGO, ILL. NUMBER 18

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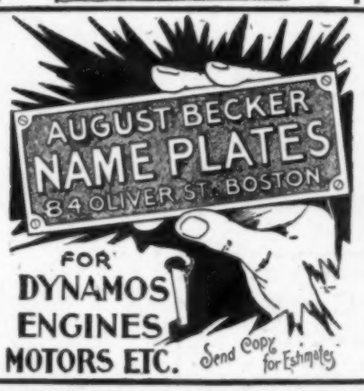

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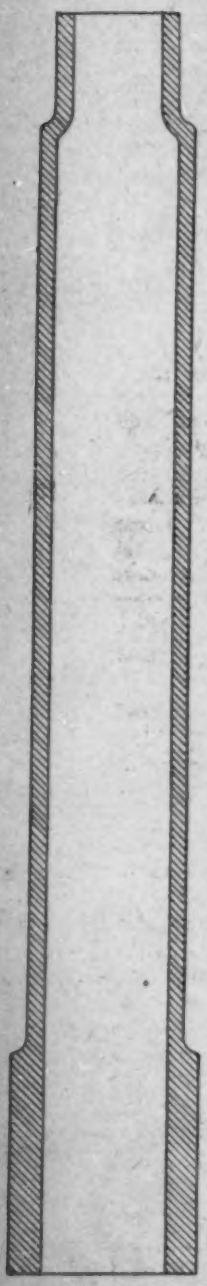

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. MAY 4, 1899. CHICAGO, ILL. NUMBER 18

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

While the market has made no new record the past week, the air has been full of rumors of changes that point to further centralization of large interests in the iron trade. Some guesses have appeared in print, ranging from a gigantic combination taking in all the large steel companies, and consolidating the consolidations, all the way to statements affecting only the status of the leading Pittsburg company. As intimated elsewhere by an officer of one of the consolidations, the exact import and extent of the pending movement has not been correctly represented in any of the publications; but an important change in the Carnegie Steel Co. is probably the most certain outcome. And whatever the ultimate status of the four companies that have been named as ripe for putting together, the prominence of the Moore Brothers and their associates in all four—presuming that the Carnegie Steel Co. deal is put through—will insure the harmonious operation of Central Western plants having a yearly output of 4¼ to 4½ million tons of steel and finished material. Just to the west of them are the Federal Steel Co. plants; and with these two groups of interests in control of the steel-making zone of the country, the maintenance of harmony and of profitable prices is put beyond hazard. To complete the program, the sheet mills remain to be added to the Moore interests, and this seems now a matter of a few weeks. It is evident from the movements on foot, and from various phases of the deals that have followed each other so rapidly in the past few months, that a good understanding can be counted on, at least, among the few large factors in the trade. Market fluctuations, and therefore market surprises, will be fewer, and long contracts will be the rule. In the past week the most active factor in the market has been gray forge iron. The American Steel Hoop Co. bought 12,000 tons for its Pittsburg and valley puddling furnaces and an equal amount is pending. Other Pittsburg sales of mill iron have also been made, and the Republic Iron & Steel Co. will be in the market as soon as its organization is completed this week. The price of Southern forge, and the basis of recent sales is $10.50, Birmingham. At Pittsburg the market is firm at $14.50 to $14.65. Foundry buying is going on quietly, but steadily, and full prices are being paid. The situation is even stronger than in April. The largest Southern producer, for example, has 350,000 tons sold for 1899 delivery, on a capacity of 1,600 tons a day which is about to be increased to 1,800 tons a day. It can be seen that comparatively little iron can yet be sold by this interest for 1899 delivery. Many other producers are nearly as well sold. Thus the dependence of a considerable number of buyers for a portion of their supply in the second half year is upon new furnaces starting or preparing to start. It appears that some of the furnace companies which had planned to start up before June 1 will not be able to obtain supplies: in other cases repair work is delayed by the difficulty of securing material. Meantime the demand of foundries and mills for prompt material is a constant pressure upon furnaces, and stocks diminish steadily. A number of furnaces, including two prominent ones in Western New York and two in Western Pennsylvania, are going out for repairs and relining. The British pig iron market has advanced sharply and there is again a chance for further export of American iron, where furnaces can consider foreign offers. A labor trouble in the Shenango valley led to the banking of four furnaces on Tuesday, but it is expected the matter will be adjusted promptly. As indicating the premium now paid for prompt steel a sale of 500 tons of slabs for Eastern shipment is reported at $27.50, Wheeling mill. Reports concerning finished material indicate rather more activity in the past week, at unchanged prices. There has been a good aggregate of small orders and some fair sales of rails.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World*, 705 PUBLICATION BUILDING, May 3.

A radical economic change is coming over the iron and steel market through the wholesale consolidation of plants and the formation of agreements between interests. In the case of companies making the same product, the result is to steady prices and remove much of the former uncertainty, and to make the buying much more uniform as to time so that there is less inclination to anticipate future wants. In the case of interests making a chain from raw material to ultimate finished product, the result is to remove completely from the market a large bulk of transactions. The iron trade is now strongly feeling the effect of these movements, and the interest is less in a recital of transactions with the tonnage and price involved, and more in the arrangements between different interests whereby the market will be affected in the different ways indicated. Where, for example, interest was formerly manifested in the probable price of a certain article, the interest now is in knowing whether in the course of time that article will be purchasable at all in the open market.

During the week under review transactions have been of minor importance, and there have been scarcely any changes in prices. The trade is on the eve of further developments which will have consequences of the broadest character, following upon the harmony which has been conspicuous for some time between what may be termed the "Big Four" in the steel producing trade, the National Steel Co., American Steel & Wire Co., Carnegie Steel Co., and the Federal Steel Co. The trade in the past week has indulged in unlimited speculation as to what is on the board, and largely as a matter of habit, it has been supposed that a merger was proposed, which is improbable. The really important matter, in view of the harmony already established, is the connections formed and to be formed between these concerns and finishing interests. Much has already been done in this direction, and more is to be done. The chains are being completed from raw material to finished product, and outside of these chains the

most important interests left will be the furnaces making foundry pig iron.

PIG IRON.—The feature of the Bessemer situation is the strike of the day laborers in the Shenango Valley furnaces, which started early in the week. As a consequence, four furnaces were banked Tuesday morning, the Atlantic, Rosena, Shenango and Neshannock, and others may have to follow. The other furnace labor is ready to work. The men were dissatisfied with their wages, although they were materially advanced only recently. Transactions during the week have been of small importance. The furnaces have no Bessemer to sell before July 1, and will enter the second half of the year behind in their deliveries. Some few lots of outside iron, making a total of only a few thousand tons, constitute all the offerings, and this iron is in such condition that it may be held for some time yet, so that the holders are asking the full price, $14 50, valley, which is hence the price for spot iron or for iron in the second half. The price of $15.15, Pittsburg, is well maintained, although there have been one or two sales in the past fortnight or so at a shade under this price. A very decided activity has developed in mill iron, and there have been some large transactions. A number of buyers who stayed out of the market for some time have been forced to come in during the past week. The market is all of $14.50, Pittsburg, and some considerable lots have been sold at $14.65, while in the valley as high as $14.25 has been done In foundry irons there was a little flurry last week owing to some furnaces entering the market with some precipitancy, but the condition is now one of strength, at prices unchanged from last report. The supply, which seems to be still under the requirements, will be little helped by the blowing in of additional furnaces. Of the new furnaces being erected, none can cut any figure this year except the two at Lorain. Of furnaces inactive for some time in this region only four, Douglas, Ella, Middlesex and Sharon, can be counted on in the near future, and the aggregate production of these will not be large. We quote the market as follows:

Bessemer, valley furnace	$14.50	
Bessemer, Pittsburg	15 15	
No 1 Foundry	15.75 to	16.00
No. 2 Foundry	15.50 to	15.75
No. 3 Foundry	15.00 to	15.50
Gray Forge, valley furnace	14.15 to	14.25
Gray Forge, Pittsburg	14 50 to	14 65

STEEL.—The steel market is irregular and devoid of noteworthy transactions. Parctically no busines of importance is being done for delivery in the second half, and for nearby delivery no steel can be had except at second hands. The market may be put at about $26 for billets. It is claimed that a few odd sales have been made of sheet bars to favored customers by two of the leading interests, but none in a way to fix a market price. A sale of 500 tons of slabs has been made by a Wheeling mill for prompt shipment to the Philadelphia district at $27.50 Wheeling. This indicates the high premium paid for spot material.

FERRO MANGANESE.—There is no change in this line, demand continuing good, and the price remains at $75 for large lots, smaller lots at higher figures.

RAILS AND TRACK MATERIAL.—The rail market is without incident, and track material is well maintained at former prices by the continued active demand. Some rail business has been booked by the local mill the past week. We still quote: Spikes, 1.80c to 1.90c; track bolts, 2.20c to 2.40c; splice bars, 1.50c to 1.70c; links and pins, 1.80c to 1.90c.

BARS.—Both steel and iron bars remain at unchanged figures, steel at 1.65c to 1.70c, and iron bars about a dollar a ton lower.

STRUCTURAL MATERIAL.—Structural steel is firm and active. The leading local interest took an order last week from the Hamilton (Ontario) Bridge Co., for about 2,000 tons of shapes. We quote prices unchanged, as follows: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees 1.55c; zees, 1.50c; and angles, 1.50c to 1.55c; universal mill plate, 2c.

PLATES.—The scarcity in plates for nearby shipment is not likely to be relieved for some time, and mills now have a comfortable aggregate of orders until fall. Spot deliveries continue to command 2.10c and even considerably more, while for later delivery 2c could be done, and for the fourth quarter orders might be placed at a shade under 2c. We quote for delivery in the second quarter: Tank, 2.10c; shell, 2.20c; flange, 2.30c; fire box, 2¾c to 3¼c.

PIPES AND TUBES.—The consolidation project is being steadily worked up, and the work of the appraisers and accountants will soon be passed upon and the subsequent operations are not likely to consume much time. Much of the other detail work in connection with the consolidation has been steadily prosecuted. The market is firm and prices remain as follows: Merchant pipe, base discount 60 per cent and additional discounts four 10's for less than carlods and four 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 52½ for screw and socket joint and 47½ for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 45 per cent; 1¾ to 2½-inch 55 for iron and 60 for steel, 2¾ to 6-inch, 60 for iron and 62½ for steel, all with an extra 5 per cent to dealers

SHEETS.—The market for sheet iron is in a very unsettled state, and scarcely any material is to be had from mills, while middlemen have disposed of almost all their holdings, and are finding it impossible to get more The resumption of very active work on the consolidation project is referred to elsewhere. It is rumored that the capitalization of the sheet consolidation will be very small in proportion to the properties absorbed, and $25,000,000 is named as the probable figure. No. 28 common sheets can be had at 2 90c, but it is questionable if this figure could be shaded, and an order for a large lot could not be placed at all. The sheet mills have not been receiving steel nearly as fast as needed, and are unable in most cases to contract far enough ahead to take care of the demand for their product. Some have had to compromise with buyers to whom they could not furnish material as specified, and agree to defer deliveries, at prices below what the material would now bring. In galvanized sheets the market is not so stiff as in black iron; and 70 and 5 per cent, with a 15-cent freight allowance, is the current rate.

SPELTER.—The spelter market has moved upward since last week, and the metal is very firm. Quotations are as follows: St. Louis, 6.60c; Pittsburg, 6.70c; New York, 6.80c to 6.85c.

OLD MATERIAL.—There is very little activity in this line and quotations remain unchanged as follows: New melting stock, $13.50 to $13.75; old steel rails, long lengths, $12.50 to $13; cut, $13 to $13 50; old iron rails, $18 to $18.50; wrought iron scrap, $15 to $16; cast borings, $8, net, Pittsburg; busheling scrap, $11 to $11.50, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12, gross; charcoal scrap, $13, gross; wrought turnings, $8 to $8 50, net, Pittsburg.

COKE.—The average daily shipments last month were a trifle greater than the record-breaking pace of March, although the total shipments were less, owing to there being but 25 working days as against 27 in March. The shipments of the leading interests were 30,452 cars, averaging 20 tons a car, or 1,218 cars a day. This is a slightly higher daily average than for March. The price is firmly maintained at $1.90 for standard Connellsville furnace coke, and for crushed and foundry $2.15 to dealers and $2.30 to consumers.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World*
1522 MONADNOCK BLOCK, May 3.

The market has been quiet, and is remarkable only for the lack of interesting news. There has been a good demand for most varieties of iron and steel, at prices which are very firmly maintained by the mills and furnaces, and the inquiry is expected to be good for some time. Deliveries on old contracts are large, and are keeping mills and furnaces busy.

PIG IRON.—The week has not been active in any respect. There have been a few quite good-sized sales, but none especially large, and the total tonnage of the week is possibly a little smaller than that of the week previous. There are several fairly good inquiries in the market, and it is thought these will develop into orders within a short time. Buying is not expected to be large during the present month, however, but there is a decided disposition to expect a heavy buying movement commencing early in June, and it is thought by furnacemen that as soon as the buying commences prices will feel the effect and will advance. The condition of the market at present is such that it would take very little to cause an advance in prices. The furnaces are all well sold ahead, and none of them are courting business for anything like short time delivery. On the contrary, most of them are sold up for the next four to six months and are quite willing buyers

should postpone purchasing for some time. Quotations are as follows:

Lake Sup. Charcoal	$17 00@$18 00	Southern Coke No. 3	$14 75@15 00
Local Coke Fdy. No. 1	15 50@15 75	Southern No. 1 Soft	15 50@16 00
Local Coke Fdy. No. 2	15 00@15 50	Southern No. 2 Soft	15 00@15 50
Local Coke Fdy. No. 3	14 50@14 75	Southern Silveries	15 50@16 02
Local Scotch Fdy. No. 1	15 50@15 75	Jackson Co. Silveries	17 00@18 00
Local Scotch Fdy. No. 2	15 00@15 50	Ohio Strong Softeners	15 50@16 50
Local Scotch Fdy. No. 3	14 50@14 75	Alabama Car Wheel	17 50@18 00
Southern Coke No. 1	16 00@16 25	Malleable Bessemer	15 50@16 00
Southern Coke No. 2	15 25@15 75	Coke Bessemer	15 50@16 00

BARS.—Business has been light. Mills do not appear to be at all anxious to run after orders, and most of them have put off buyers until after the result of the Republic Iron & Steel Co. negotiations is known. There has been considerable demand, and several quite large contracts have been closed, although the aggregate tonnage for the week was smaller than usual. No further developments have been made in the consolidation plans, but it is thought the final announcement cannot be delayed much longer. The bar mill of the South Chicago Furnace Co., which is undergoing repairs, will be ready for operation within the next sixty days, it is expected. Common iron is quoted at 1.60c to 1.75c, and steel bars at 1.65c to 1.75c, half extras.

STRUCTURAL MATERIAL.—New business has been light, with only a few small orders closed, and no large contracts. The only large business of the week was the opening of bids on two drainage canal bridges, one of 2,500 tons, and one of 500 tons. The contracts were not let last week, but the low bidders were the Pennsylvania Steel Co., on the larger and the Chicago Bridge & Iron Co., on the smaller bridge. Another bridge contract, taking about 3,500 tons, will be let by the Drainage Canal Commissioners, May 10. Mills are all full of orders, and specifications on old contracts are coming in as fast as they can be handled. The market is firm and unchanged. Quotations are as follows: Beams, 15 inches and under, 1.65c to 1.70c; 18 inches and over, 1.75c to 1.80c; angles, under 3 inches and over 6 inches, 1.75c to 1.80c; 3 inches to 6 inches, 1.65c to 1.70c. Sheared plates, 2.25c to 2.30c; universal plates, 2.25c to 2.30c; tees, 1.70c to 1.75c; zees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

BILLETS AND RODS.—Local mills are full of orders, and are unable to take business. Sales in this market have been small, both in billets and rods. Prices are about as follows: Bessemer billets, $26 to $27; open-hearth billets, $29 to $30; rods, $34.50 to $36.50.

PLATES.—The demand for plates continues large, and sales last week from store were excellent. Mills are unable to take much business for nearby delivery, and are not willing to sell very far ahead. Quotations are unchanged as follows: Tank plates, 2.25c to 2.30c; flange steel, 2.35c to 2.45c; marine steel, 2.45c to 2.55c; fire box steel, 3c and upwards.

SHEETS.—There has been a good demand for both black and galvanized sheets, and several quite large contracts for the former were placed last week. Prices are very firm at 2.85c to 2.90c for No. 27, black, and 75 per cent off for galvanized, mill shipments.

MERCHANT STEEL.—Most mill agents report full order books for the summer months, and that they are unable to take large business for delivery before fall. The few mills that can handle immediate delivery business are getting all they need at full prices. Quotations are as follows: Open-hearth spring, tire and machinery steel, 2.40c to 2.45c; smooth-finished machinery steel, 2.45c to 2.55c; smooth finished tire steel, 2.25c to 2.35c; tool steel, 6c to 7.50c; specials, 10c and upwards.

RAILS AND TRACK SUPPLIES.—There is considerable demand for small lots of light rails, and the local mills are taking some orders of this character. We quote: Standard section rails $26 to $27; light rails, $26 and upwards; steel splice bars, 1.40c to 1.50c; track bolts with square nuts, 2.15c to 2.25c; hexagon nuts, 2.25c to 2.30c; spikes, 1.85c to 1.90c.

WIRE AND WIRE NAILS—The demand keeps up well, and sales last week were fully as large as those of the week previous. Prices are as follows: Plain wire, $1.95; galvanized, No. 14 and heavier, 50c advance; Nos. 15 and 16, 85c advance; Nos. 17 and 18, $1.10 advance; wire nails, $2.10; barb wire, painted, $2.20; galvanized, $2.70. All prices are f. o. b. Pittsburg and Cleveland, and on carload shipments all rail freight is added, making a delivered price. Single carload lots are quoted 10c higher.

SCRAP.—The market has been quiet, with only comparatively small sales of any grade. One order of 500 tons of railroad wrought was taken in the week. Mills are not buying, but are waiting for bar mill consolidation plans to develop. Prices are unchanged, and are inclined to be higher on some grades. Dealers' selling prices are as follows:

Old iron rails, gross	$18 50@$19 00	Axles, net	$19 00@$20 00
Old steel rails, long, gr.	13 00@13 50	Cast borings, net	6 00@6 50
Old steel rails, short	11 50@12 00	Wrought turnings, net	8 50@9 00
Old wheels, gross	16 50@17 00	Axle turnings, net	10 00@10 25
Railroad forge, net	16 50@17 00	Mixed steel, gross	8 00@8 50
Dealer's forge, net	12 00@15 00	Stove plates, net	9 00@9 50
No. 1 mill, net	10 50@11 00	Heavy melting steel, gr.	10 50@11 00
Heavy cast, net	13 00@13 25	Old iron splice b., net	18 50@19 00
Malleable cast, net	8 50@9 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World*, 27 VINCENT ST., May 3.

Two big ore cargoes have been unloaded at Lake Erie port in the past week—the beginning of the movement for 1899. The ore is from Escanaba. Lake Superior loading is still delayed, however, a number of boats that attempted to get out of Duluth on Tuesday, May 2, being held back by the ice. Last year 252,000 tons of ore passed through the Sault in April; a week of the present month may pass before the record for 1899 is started. In view of the shortened season and of the large amount of ore sold, preparations are being made at Lake Erie docks to give the maximum dispatch this season. At Conneaut the Carnegie docks, as noted elsewhere, will push unloading work day and night.

At Cleveland the C. & P. ore docks are under the management of M. A. Hanna & Co., beginning May 1. Increased receipts for 1899 may be expected at this port. It is evident, as the season's work begins that all the machinery of ore transportation, from mine to furnace, will be taxed to do the work laid out; and back of this is the problem of getting the ore from the mines. In no recent year has there been any such doubt about the ability of the mines to respond to the call upon them. The prices obtained on later sales of ore, in such lots as have been left from the early rush, are unpleasantly suggestive to selling firms, of their benevolent attitude at the opening. The advances secured in March and April sales were 50 cents, 60 cents, and in some instances 75 cents above the original basis. Now, stray lots are being held for figures as high, in a few cases, as $1 above first sales.

PIG IRON.—The market for foundry iron is being followed by foundrymen more closely than ever, and there is some buying, but nothing large. Some sales of foundry iron on malleable specifications—close to Bessemer iron, except that phosphorus is higher—have been made in this market the past week for shipment to other districts. The output of foundries is unprecedented; and this fact has led some buyers to pay current prices and make sure of their iron. Some others, with the next two or three months covered, are holding off on purchases for the second half, to take the measure of the new furnace capacity about which there is more generalization than definite information, or, in some cases, probably of early tangible outcome. There is considerabe activity in gray forge, and more business that must soon be closed. The mills have been simply waiting for the completion of the Repulic Iron & Steel Co. In the past week a sale of Southern was closed involving 12,000 tons for Pittsburg and valley delivery, and 12,000 tons more is pending. Recent sales of Southern were at $10.50, Birmingham, or $14.20 delivered in the valley. For Northern $14.50 is quoted. Lake Superior charcoal is sold practically to the end of the year, the last business closed being at $18, Lake Erie dock. We quote Cleveland prices:

Bessemer	$15 15	Valley Scotch No. 1	$15 75@16 00
No. 1 Strong Foundry	15 65@15 90	Valley Scotch No. 2	15 25@15 50
No. 2 Strong Foundry	15 15@15 40	Gray Forge, valley	14 25@14 50
No. 3 Foundry	14 75@15 00	Lake Superior Charcoal	17 00@18 00

FINISHED MATERIAL.—The market is firm in all lines, yet without signs of further advances. The difficulty of getting material when needed is the only drawback to the buyers of smaller quantities; but in the main, jobbers are able to take care of their trade owing to the forehanded policy early in the present movement. All along the line consumers are working on a narrow margin of material, and correspondence by wire and by mail has much to do with hurrying deliveries. Boiler, tank and sheet metal workers are all affected. We quote: Steel bars, 1.65c to 1.75c, Pittsburg; bar iron, 1.50c to

1.55c, at valley mill; beams and channels, 1.50c, Pittsburg; sheets, 2.85c, Pittsburg, for No. 27 common. Cleveland sales out of stock are made at 1.60c, half extras, for bar iron; 3c for No. 27 black sheets, and 70 and 10 off for galvanized. Wire nails are unchanged at $2.10 to jobbers and $2.20 to retailers in car lots, Cleveland mill. Smooth wire is quoted $1.95 to jobbers in carload lots. On galvanized 50 cents extra is charged for Nos. 6 to 14, inclusive. Barb wire is $2.20 for painted in carload lots and 50 cents advance for galvanized.

OLD MATERIAL.—Mills need to buy but are waiting for the coming in of the Republic Iron & Steel Co. officers. The market is unchanged at figures recently prevailing: No. 1 railroad wrought scrap, $16 in the valley; old iron rails, $18.50 to $19; old steel rails, $13.50 to $14. The Cleveland market for machinery cast scrap is $12 to $12.50; for old car wheels, $16; cast borings, $8; old iron axles, $18 to $19.

CINCINNATI.

May 2.

The marked feature of the situation during the past week has been the a nount of gray forge that the Southern furnaces have sold and the heavy inquiries for the same grade of iron. This week should all the deals which are now pending go through, Southern order books will be swelled to the extent of 25,000 tons. Of course it is too early to say what the result of the pending negotiations will be, but they are very likely to decidedly strengthen the situation. There has been a fair run of orders for foundry grades, but buyers are learning by experience that prompt shipment is not to be expected. There is no sign of weakness in any quarter; on the contrary the market as far as the South goes is in the first week of May stronger and in better condition generally than it was a month ago. The business of the week has aggregated a large tonnage, and as may be supposed, comprehended every variety of iron obtainable. The market is strong, with an advancing tendency. We quote for cash f. o. b., Cincinnati: Southern coke, No. 1 foundry, $15.25; No. 2, $14.25 to $14 75; No. 3, $13.75 to $14.25; No. 4 and gray forge, $13 to $13.50; mottled, $13 to $13.50; No. 1 soft, $15.25; No. 2 soft, $14 25 to $14.75; Lake Superior coke, No. 1, $16.25 to $16.50; No. 2, $15.75 to $16; Hanging Rock charcoal No. 1, $20 to $21; Jackson Co. silvery No. 1, $17 to $17.50; Standard Georgia car wheel, $15.75 to $16.50; Lake Superior charcoal, $18.75 to $19.25.

PHILADELPHIA.

May 2.

The market retains all its strength, but data as to the supply of iron available in the second half of the year are lacking, and buyers in some instances are waiting to be more definitely informed as to the amount of iron that will be added by the furnaces now going in or preparing to get in blast. Some of them are vaguely expecting that present prices will yield after the second quarter, but to get satisfactory assurance of this is the difficulty. At the moment the indications are against such a change in prices, but the problem in the case of foundrymen is to get their trade up in proportion, as present contracts expire. Sales for the current week are small compared with those earlier in the year; but this waiting condition may even be continued for several weeks. Furnaces are so well sold that they are glad to wait for further light on the more remote months of the year. With some of the furnaces planning to start it is a question whether concessions would increase sales with buyers in their present mood. Those who have any faith in lower prices later in the year expect to realize these on standard brands. But there is not now the slightest indication that such an expectation will be realized. Producers are naming quotations only on small or moderate lots, and are showing no disposition to advance prices; indeed, to buyers who are now getting iron on contracts $4 or $5 a ton below to-day's prices, it is hard enough, in renewing, to pay ruling prices. Sales for shipment in the next two or three months are at $16.50 to $17 for No. 1X foundry; $15.75 to $16 25 for No. 2X; $15.25 to $15.50 for No. 2 plain; $15 to $15.25 for mill and basic irons; and $19.50 to $20 for low phosphorus pig. The steel market continues quiet. Very few billets are available and $28 is paid for small prompt shipments. The mills report a good small-lot demand, which keeps order books in excellent condition. Very little material ordered now can be delivered short of mid-summer, and jobbers who succeeded some months ago in getting round orders placed with mills are proving their title to be regarded as factors in the trade. There is a general disposition to accept the present price basis as quite well established, at least for this year, and matters are assuming more nearly a routine aspect. We quote for seaboard or equivalent deliveries, 1.45c to 1.50c for ordinary bars; 1 55c to 1.65c for refined bars; 1.80c to 1.90c for steel bars; 2.25c to 2.40c for tank plates; 1.65c for beams up to 15 inches; angles 1.65c to 1.75c.

PROPOSED CRUCIBLE STEEL CONSOLIDATION.

Since early in the year there has been a "gentlemen's agreement" among the manufacturers of tool steel regarding the selling price of their products. The agreement was entered into as a preliminary step to a consolidation under one ownership of all the properties, and the negotiations to this end have now well advanced and it is probable that the transfer to the new company can be effected shortly. The utmost secrecy has surrounded the operations so far. It is stated that the reorganization of Park, Brother & Co., into the Park Steel Co., recently effected, was made by the owners in consideration of the probability of the plant's being absorbed by the combination. The copper branch of the Park business has been for some months in the pool formed to control the sale of finished copper, the pool paying the company a pro rata for the quantity by which its output may fall below its allotment, and receiving a pro rata for the quantity in excess, when the output is above the allotment. It is probable that the copper department will not be included in the crucible steel consolidation. The Pittsburg companies which it is understood will enter the crucible steel combination are: Crescent Steel Co., Braeburn Steel Co., Park Steel Co., Howe, Brown & Co., Singer, Nimick & Co., and Anderson, DuPuy & Co.

Plans for a New Rail Mill in the Pittsburg District.

A project has been quietly maturing for the erection of a steel rail mill at Beaver Pa. The land has been secured and the capital necessary is in sight. The location is an advantageous one, being a portion of the level land between the Ohio and Beaver rivers, and something like 200 feet below the tracks of the P. & L. E. Railroad, which crosses the track on a trestle. A ship canal is to be dug from the point where the Beaver flows into the Ohio river, up to the site of the works. The raw material for the furnaces will be assembled near the level of the railroad tracks, and above the tops of the blast furnaces, so that there will be no hoisting. It is proposed to build two 500-ton furnaces, with Bessemer steel department and blooming and rail mill to finish the entire product into steel rails. The projectors claim they will depend entirely upon the foreign demand for a market, the rails being taken to tidewater by the Ohio and Mississippi rivers. The dams in the Ohio will be completed shortly, and it will be possible to ship by water to New Orleans at all seasons of the year. The preliminary work has been in the hands of Capt. M. S. Marquis, and his brother, William E. Marquis. The land secured amounts to about 75 acres, the price paid being about $3,725 per acre. It has about 3,600 feet frontage on the Ohio river.

Obituary.

Lucius M. Pitkin, president of the Variety Iron Works, of Cleveland, was struck by a Lake Shore train at Coit's Station, near Cleveland, on April 29, and instantly killed. He was 74 years old. In 1868 he organized the Cleveland Malleable Iron Co., and was its president. Later it was merged into the National Malleable Castings Co. He had been president of the Variety Iron Works from the organization of the company.

Wm. C. Dickey, president of the Cumberland Steel & Tin Plate Co., Cumberland, Md., died April 18, aged 59. Howard H. Dickey, secretary of the Cumberland plant, and William C. Dickey, connected with the New York office of the Cambria Steel Co., are surviving sons.

Frank B. Davis, of Chicago, president of the Davis & Ludwig Foundry Co., died last week, aged 50.

H. B. LUSCH & Co., dealers in commercial paper, have removed their offices to 200 La Salle st., Chicago.

STANDARDIZED PIG IPON DRILLINGS.

TO THE EDITOR:

What are standardized drillings? and for what are they used? are questions many foundrymen and others are asking. In brief, these drillings are from specially prepared and analyzed samples of iron, by which the chemist can test the accuracy of his work. Almost every trade possesses some means by which its artisans can tell whether their labors have been productive in obtaining the perfection desired. The appearance of the finished casting indicates to the furnaceman and founder the results obtained from their iron. A trial of a machine or engine shows the engineer or machinist the perfection they have obtained, but the completion of an analysis by a chemist presents no tangible evidence of the accuracy of his results. The only way a chemist can know of the correctness of his analyses or give other assurance that his work is right, is by having his results checked or by analyzing drillings that have been determined by competing chemists to learn whether results agree. This latter process is, in a sense, to him a method of checking similar to the use of standard weight to test the accuracy of scales. No laboratory is complete without its standards, any more than a furnace or founder could be, were it without standard weights for occasionally testing its scales.

The necessity for a laboratory having something in the way of standardized drillings has led many heretofore to make their own. This generally has been done after the following plan: The chemist, having decided upon the grade of standard thought best for his work, sought out a piece of clean pig metal of such grade and drilled it until he had obtained from eight to 12 pounds of drillings. These in turn would be well mixed, and, in some cases, ground in a mortar to make them sufficiently fine to pass through a ten, twenty or forty mesh sieve. This done, he would put up packages of a few ounces each and mail them to other chemists with a request that they analyze them for metalloids for which he had decided to obtain standards. When the different results had been reported, he would accept the average as his standard for the drillings in his possession, and which were generally preserved by tightly sealing in a bottle, labeled with the analyses, and kept at hand for use at any time.

These standardized drillings being accepted as containing certain percentages of carbon, silicon, sulphur, manganese or phosphorus, could be re-analyzed at any time to check up the chemists' own or others' determinations An observing person, having an opportunity to visit these laboratories, could often find the chemist using his standards to test chemicals or some new short-cut methods that he or some other chemist had devised. Then again, they might be used to check up his own work or that of others, when the correctness of results had been questioned. In re-analyzing a standard, should the same results not be obtained as were accepted for a standard, the chemist was naturally left to conclude that some of his chemicals, methods or work was at fault.

The process by which individual chemists obtained their own standards was as a rule long and tedious. It often took from four to six months before they could get in all results from their friends. Then again, from what the writer has seen of such reports, he could not have the utmost confidence in the standards thus obtained, for, as a rule, the results would vary so much that the average accepted would at times seem to partake more of guess work than anything coming from accurate work or methods. The variations of analyses thus obtained could only cause great differences in standards in use in different circles, and often perplex managers of steel works, blast furnaces, foundries and chemists rather than help in correcting evils and preventing losses.

It was the opportunity of observing the practice of blast furnaces in obtaining their standards which led the writer to conceive the idea of one central agency from which all could obtain standardized drillings, which had been determined by a few of our best known chemists. The first difficulty lay in obtaining 300 or more pounds of drillings, sure to be uniform throughout. This called for the ability to make a casting weighing 500 pounds or more that would be perfectly clean, sound and homogeneous in its structure. To do this successfully demanded a broad experience in the art of founding. For this reason a well-known writer has recently said that establishing and maintaining a central standardizing agency is properly foundrymen's work. Believing this to be true, the writer labored to have the American Foundrymen's Association take up this work at its last convention; and having been honored with the chairmanship of its committee, he has worked with his associates, Dr. R. Moldenke, and James Scott, of Pittsburg, P. W. Gates, of Chicago, and E. H. Putnam, of Detroit, to make this association's standardizing bureau a success.

It is but little more than three months since our committee has had drillings ready for distribution. Since that time, the following laboratories, 80 in number, have ordered the association's standards:

Blast Furnaces—Ashland Coal, Iron & Railway Co., Pickands, Mather & Co., Monongahela Furnaces, M. A. Hanna & Co., Sharpsville Furnace Co., The Spearman Iron Co., Mabel Furnace Co., Stewart Iron Co., Brier Hill Iron & Coal Co., Andrew Bros. Co., Girard Iron Co., Longdale Iron Co., Everett Furnace Co., Warwick Iron Co., Embreville Iron Co., Tennessee Coal, Iron & Railway Co., Hamilton Blast Furnace Co., R. Heckscher & Sons, Dora Furnace Co., McNair & DeCamp Co, Allegheny Iron Co., Northwestern Iron Co., Iroquois Iron Co., Tonawanda Iron & Steel Co., Elk Rapids Iron Co, Ohio Iron & Steel Co., Penn Iron &Coal Co., Thomas Iron Co., New River Mineral Co., Emma Furnace.

Steel and Iron Works.—Illinois Steel Co., Kittanning Iron & Steel Co., Sharon Iron Works, Youngstown Steel Co., Bethlehem Iron Co., Pennsylvania Steel Co., Ashland Steel Co., Carnegie Steel Co., Clinton Iron & Steel Co., Sloss Iron & Steel Co., Atlanta Iron & Steel Co., The Watt Iron & Steel Co., Reading Iron Co., The Martin Iron & Steel Co.

Colleges.—Harvard College, Worcester Polytechnic Institute, Lehigh University, Columbia University, University of Pennsylvania, University of Michigan, Massachusetts Institute of Technology, Ohio State University, Yale Universtiy, Michigan College of Mines, Havemyer University, Wester University, University of Minnesota.

Private Laboratories.—Rome Testing Laboratory, Walter M. Sander, Providence; Enrique Tonceda, Albany, N. Y.; Durand Woodman, New York City; C. E. Lineberger, Chicago; R. C. Hindley, Racine, Wis.; Ludw. Loene & Co., Berlin; Edward J. Wheeler, Albany; Wm. J. McGavok, Pulaski, Va.; Dickman & McKenzie, Chicago; F. A. Emmerton, Cleveland, O.; Mariner & Hoskins, Chicago.

Iron Foundries.--Frank Kneeland Machine Co., Pittsburg Locomotive & Car Works, McConway & Torley Co., J. I. Case T. M. Co., Syracuse Chill Plow Co., Gates Iron Works, Sargent Co., Draper Co., Builders Iron Foundry Co., Snow Steam Pump Co., William Cramp & Sons.

To show that the work is being endorsed by the best concerns of our country, the following extracts from a few of the testimonials received, are given:

Theodore Wm. Richards, Chemical Laboratory of Harvard University: "Your plan to systematize this useful work and to carry it out on a larger scale appeals strongly to me, and it is to be hoped that the outcome may be fruitful in benefit both to the makers and to the users of iron."

H. L. Mills, Prof. Analytical Chemistry, Sheffield Scientific School of Yale University: "Permit me to express my belief that this work of your association of distributing carefully analyzed samples of pig iron is of great value to the metallurgists and chemists of this country."

Wilson Miller, President Pittsburg Locomotive and Car Works, Pittsburg, Pa.: "Yours of the 27th inst. received, and having been referred to our chemist and engineer of tests, he makes the following report: 'In reference to the A. F. A. standards, would say I am pleased with them and take pleasure in endorsing them.'"

R. Heckscher & Sons, Swedeland, Pa.: "We take pleasure in this opportunity to give you a word of encouragement. Trusting that you will be successful in interesting all users and makers of pig iron."

Edgar S. Cook, president Warwick Iron Co., Pottstown, Pa.: "It is no little comfort to have the standardized samples and to know that the work of our laboratory is correct and reliable."

L. C. Phipps, 2nd vice-president Carnegie Steel Co., writes: "We are using standardized drillings for standardizing solutions of sulphur and phosphorus, also for checking other determinations of silicon graphite, carbon and manganese, and find them very useful in our laboratory. We think it very necessary that laboratories should be supplied with standardized drillings, especially those working on blast furnace products."

Frank Kneeland Machine Co.: "The thanks of all users of iron and employers of chemists are due your committee."

Syracuse Chilled Plow Co. W. W. Wiard, Ass't Sec'y: "We do not see how any firm can afford to do without them as they are worth many times their cost." THOS. D. WEST.

Sharpsville, Pa., April 28, 1899.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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THE GREATER IRON AND STEEL COMBINE.

Publications have been plentiful in the daily papers, mainly through special dispatches from New York, Pittsburg and Chicago—in the past week, concerning plans for a still greater consolidation of iron and steel interests. One report is that all the large steel companies, including the Federal Steel Co., Carnegie Steel Co., National Steel Co., with the allied interests of the latter, the American Tin Plate Co. and the American Steel Hoop Co., and not omitting the American Steel & Wire Co., are to be merged in a single corporation. Of this there is no probability at the present time, and the whole report may be safely discredited.

Interest has centered, however, in statements connecting the Carnegie Steel Co. with the National Steel Co., American Tin Plate Co., and American Steel Hoop Co. One report has been that the four would be consolidated into the National Carnegie Steel Co., with H. C. Frick as president. There has been also the report that the three last named companies, representing what are known as the Moore Bros. interests, would go together in one. The change of the Carnegie Steel Co. from a partnership to a corporation has also been discussed as a separate proposition. While actual verification of any of these reports is difficult, at present, the truth seems to be that the Moore Bros. and associates have been negotiating for a considerable interest in the Carnegie Steel Co., and some early outcome from the negotiations may be expected. It is well known that the steel sheet combination, as noted in another column, is coming along toward completion, and that this will make the fourth of the so-called Moore companies and will become an important outlet for the product of the National Steel Co.

An executive officer of one of the consolidations named makes this statement to *The Iron Trade Review*: "There is no truth in the story of a consolidation of the Carnegie Steel Co., National Steel Co., American Steel Hoop Co., and American Tin Plate Co. No deal has been made for a consolidation of any of the companies named, and while it is true that there has been some talk of a consolidation of several of the steel companies, nothing definite has come of it. No announcement of plans, either official or unofficial, can be made. It is unlikely, in any event, that the Carnegie Steel Co. will be actually consolidated with any other steel company. However, close trade relations between the Carnegie Steel Co. and the National Steel Co., American Tin Plate Co. and American Steel Hoop Co. may result from negotiations under way within the past week."

It would not be surprising if some definite announcement concerning the Carnegie Steel Co., in the above connection, is made within the week.

Munising Furnace Co.

The organization of the Munising Furnace Co., of Munising, Mich., reference to which has been made in these columns, was completed at a meeting in Cleveland on Friday, April 28. The company has an authorized capital of $300,000 and a paid-up capital of $250,000, and it is the intention to begin at the earliest possible date the erection of a modern charcoal blast furnace at Munising.

All labor saving features that can be incorporated will be provided, and output is expected to be from 100 to 125 tons a day. A chemical plant will also be erected, and the by-products from charcoal burning will be manufactured—acetate of lime, wood alcohol, etc. The stockholders of the company are all men of large experience in one or more departments of the industry. The board of directors chosen last week consists of the following: President, W. H. Hinkle, of the Ashland Iron & Steel Co., Ashland, Wis.; vice-president, R. J. Gaffney, of the American Charcoal Co., Bradford, Pa.; treasurer, N. B. Bubb, of the American Charcoal Co., Williamsport, Pa.; Thos. Keery, of the American Charcoal Co., Hancock, N. Y.; Harvey H. Brown, of H. H. Brown & Co., Cleveland; Robert E. Morrison, manager of the Munising Railway Co., Munising, Mich.; E. H. Scott, Laporte Ind.; Henry J. Pierce, of the Manhattan Spirit Co., Buffalo.

Mr. Hinkle will have charge of the erection of the furnace and the management of the business. He will also continue in the management of the Hinkle Furnace at Ashland. Thos. Keery will have charge of the erection of the chemical works and their management. The company has secured valuable concessions from the land and railroad companies so largely interested in Munising. An office will be opened shortly in the Monadnock Bldg., Chicago, of which announcement will be made, but meantime all communications may be addressed to the Munising Furnace Co., W. H. Hinkle, president, Ashand, Wis.

Republic Iron & Steel Co.

It was the expectation that the meeting for organization of the Republic Iron & Steel Co. would be held in New York on Tuesday of this week, but a number of details required still to be arranged, and the selection of officers was postponed till the latter part of the week. Some further negotiations or properties are said to be pending. The list as it stands to-day includes the 34 properties mentioned in the original prospectus of the company, published early in April, with the addition of two plants acquired in the last ten days; the Peoria Steel & Iron Works, of Peoria, Ill., and the Williams Rolling Mill, at Muscatine, Ia., owned by Mrs. Jane Clark, of Pittsburg. The capacity of the Peoria plant is 30,000 tons a year of bars, bands, hoops, cotton ties, special shapes and agricultural implement material. The capacity of the Muscatine plant is 15,000 tons a year.

Fire Brick Consolidation.

Reference was made in these columns some time ago to negotiations then on foot for the consolidation of the fire brick interests of the country. This movement has been particularly active in the Ashland, Ky., district, and thus far the tangible results are confined to that district. Within the last few weeks all the 14 fire brick companies in the Ashland district have given options on their plants to New York parties, and the prospects of a consolidation are said to be good.

A DEMONSTRATION of the Amalgamated Association in the "First District," centering in Pittsburg, was held Saturday, April 22, more than 2,000 members participating in a parade, previous to the meeting in Old City Hall, at which speeches were made by the local leaders.

THE SHEET MILL CONSOLIDATION.

The situation in the proposed sheet mill consolidation is now entirely cleared up. When the matter was first broached, in the latter part of last year, many of the sheet manufacturers were unable to see the benefits of the proposed consolidation as plainly as did the promoters, and were unwilling to enter into the matter as a plain business proposition. The important developments since that time, however, have totally changed the aspect of affairs. The National Steel Co. has been formed, and practically controls the entire output of sheet and tin plate bars in the country, thus ensuring to the sheet consolidation when formed, immunity from outside competition. Moreover many arrangements have been completed, and others are proposed, still further strengthening the position of the National Steel Co., in the way of reducing its costs and broadening its field, so that the formation of a sheet mill consolidation, to be closely allied with the National Steel Co., has become a very attractive proposition. At the same time, some differences which developed among the sheet manufacturers in regard to the positions which the leading members of the trade should occupy in the new company have been satisfactorily adjusted.

In view of the conditions surrounding the trade, and the fact that the sheet mills embrace a wide variety of equipment and facilities, the matter of handling the options has been placed in the hands of I. W. Frank, president of the Frank Kneeland Machine Co., who is well fitted to form an accurate opinion as to the value of the different plants. The options were definitely called for some time ago, and a number of them are now in awaiting consideration. No action will be taken until about all are in. Mr. Frank's offices in this connection have just been opened and are located on the fourth floor of the new Smith Building, Sixth st. and Liberty ave., Pittsburg.

Scarcely any official information can be secured relative to the position of the negotiations. As to the personnel of the company to be formed, nothing is given out, but the opinion has grown of late that the president will be G. G. McMurtry, now president of the Apollo Iron & Steel Co., and it is pretty well understood that all necessary arrangements have been made, outside of placing the valuations on the plants. This will not take much time now, and the sheet company may be ready to take hold some time early in June, and probably in no case later than July 1.

Lake Superior Iron Mines.

The Iron River mine, in the Iron River district, Menominee range, acquired some months ago by the Oliver Iron Mining Co., is to be known hereafter as the Riverton. The Isabella property, also taken by the same company, is about a mile distant from the Riverton. The Miller is another member of the same group, as is the Dober, which was purchased recently from the Mastodon Iron Co. *Iron Ore*, of Ishpeming, states that in order to work the Riverton safely and economically the Oliver company will probably divert the course of the Iron River. With the river overhead the work of safeguarding will be expensive.

Capt. Joseph Sellwood is conducting unwatering operations at the Sunday Lake mine on the Gogebic range. The property was dismantled by the last lessees and machinery must be put in. At the Iron Chief, under the same management, exploring pits are being sunk beyond the old mine workings. Some work is being carried on at the Pike also.

The Imperial mine has been secured under lease by Pickands, Mather & Co. and the Cleveland-Cliffs Iron Co. It is on the northwest quarter of Section 25, 48, 31, Marquette county, Mich., just west of Lake Michigamme. The ore is a limonite containing 58 per cent iron, 0.2 per cent phosphorus and 5 per cent silica. It has been worked heretofore in open pit.

The Cleveland-Cliffs Iron Co. has secured under lease, with option of purchase, the Volunteer mine, at Palmer, Mich., a Cascade range property. The mine has been idle for three years. Unwatering has begun and the mine will be actively wrought this season. From the beginning the Volunteer has produced 1,074,788 tons. The ore runs 58 to 59 in iron and about .06 in phosphorus, and is well adapted to be used with low phosphorus Mesabi ores. Secretary R. A. Alger is the principal shareholder in the Volunteer Iron Co., which owns the fee of the mine.

There has been considerable inquiry for Lake Superior iron mining stocks recently and all signs point to further acquisitions by consuming interests, sooner or later. Some offers for Champion Iron Co. stock are reported recently at $40, whereas the stock has scarcely been quoted for several years, transactions being in the neighborhood of $25. The Cleveland-Cliffs Iron Co. stock has also been inquired for considerably of late, sales having been made at $90. Chandler is $59 and $60, and Republic Iron Co., which went as low as $8 three years ago, has sold recently at $16 and $17.

Personal.

A. C. Hawes, manager of the Chicago office of Matthew Addy & Co., has returned from a six months' stay in New Mexico, very much improved in health. Mr. Hawes will be given a warm welcome by Chicago pig iron buyers.

President G. G. McMurtry, of the Apollo Iron & Steel Co., Pittsburg, has sailed for Europe.

President Schwab, of the Carnegie Steel Co., Ltd., has secured through Congressman Dalzell one of the guns of the Spanish battleship Viscaya for Pittsburg. It will be placed in Schenley Park.

Axel Sahlin, the well-known engineer, is now in this country. He is manager of the Millom & Askam furnaces in England.

C. L. Miller, formerly general superintendent of the Joliet Works of the Illinois Steel Co., has been appointed by the American Steel & Wire Co. as general superintendent of the Pittsburg district.

B. H. Thwaite, of the Blast Furnace Power Syndicate, London, Eng., is expected to visit this country in June, with a view to introducing his system of using blast furnace gas for power. Both in England and on the Continent the employment of gas engines, supplied with blast furnace gas, to furnish power to furnaces and auxiliary plants, is being followed with much interest.

Coke Workers Advanced to the Maximum.

The 12,000 employes of the H. C. Frick Coke Co. were notified on April 29 of an increase in wages ranging from 6 to 12½ per cent. The advance became effective May 1 and affects also the employes of the McClure Coke Co., which is controlled by the Frick interests. The new scale will greatly exceed the highest prices ever paid in any other mining or coke region. The maximum rate of increase will be paid to the employes who are now receiving the lower wages. The advance brings the mining rate up to a figure never before reached, $1 12½ for every 100 bushels of coal. It will give to the drivers, track-layers and other day men employed in the mines, $2 12½ per day. Coke drawers, under the new scale, will receive 64 cents per 100 bushels of coal charged, making the price per oven from 60 cents to $1, according to the size of the oven. The average day's work for coke drawers is two and a half ovens of the larger size.

Other companies in the Connellsville region have granted the advance, also, so that about 18,000 workers will benefit by it. These companies are the Hecla Coke Co., W. J. Rainey, Cochran Sons & Co., J. L. Dillinger & Co., the Cambria Steel Co., the Oliver & Snyder Steel Co., the Standard Coke Co., and the Dunbar Furnace Co. The increased earnings of the employes range from 6 to 12½ per cent.

It is stated that while Rosena Furnace of the Oliver & Snyder Steel Co. has been acquired by the National Steel Co., and the Oliver one-sixth of the Carnegie-Oliver ore goes to the same company, under a twenty-year contract, the two Oliver coke properties which together have 629 ovens, have not been sold to the National Steel Co.

The annual meeting of the Western Foundrymen's Association will be held at the Great Northern Hotel, Chicago, at 7:30 p. m., May 10. The election of officers for the coming year will be held, and several matters of importance will be considered, particularly the attitude of the association regarding prices and credits.

ACME SEPARATOR.

A separator for the removal of water or oil from steam, under patents controlled by Schaeffer & Budenberg, is manufactured at the works of this company at Brooklyn, N. Y. Its construction is shown in Figs. 1 and 2, the former being the horizontal and the latter of the vertical type. Experiments made by Prof. R. C. Carpenter, at Cornell University, and his report shows that when mixtures of steam and water containing as high as 40 per cent of water entered the separator, the discharge steam contained less than ¼ of 1 per cent. When the entering steam was moving at a rate of over 200 feet a second and carrying large amounts of water, the discharge steam was found to contain less than ⅓ per cent. These results were accomplished without any sensible reduction in pressure.

The vertical form of the separator may be located directly above the throttle of the engine and is of such shape as to

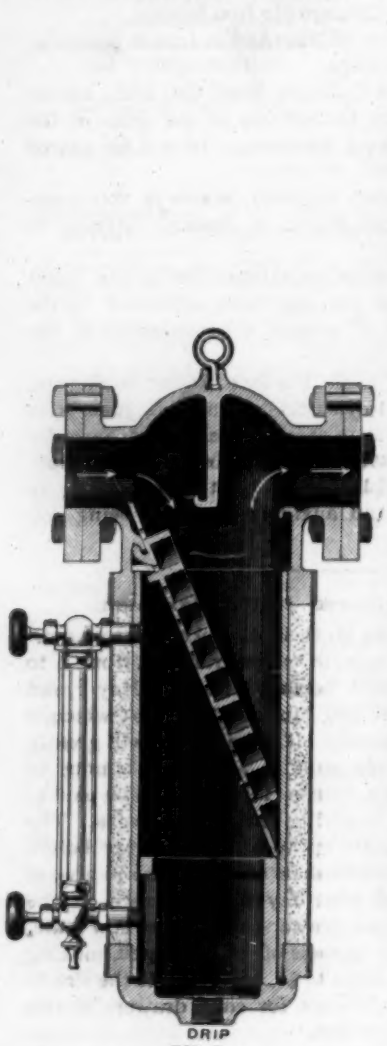


FIG. 1.

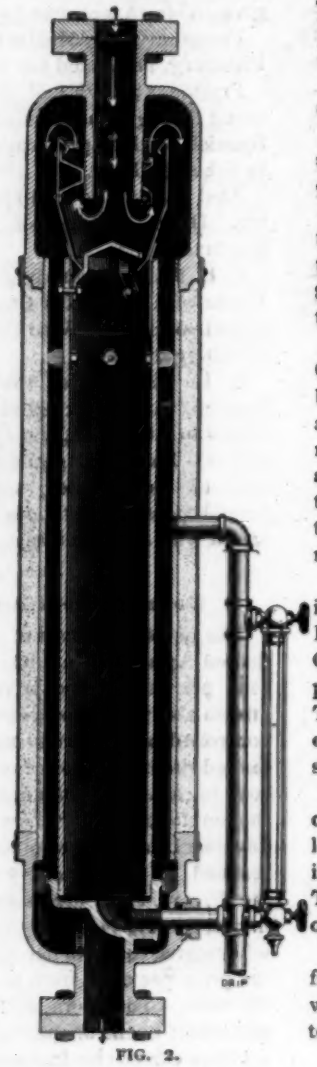


FIG. 2.

harmonize with the steam piping. It does not have any part projecting from the pipe line and has asbestos lagging covered by polished sheet iron with brass bands. To insure the best operation of the separator it is connected with a discharge trap which receives the water as fast as separated and removes it rapidly to any desired point. The danger to steam machinery from an excessive amount of water passing over with the steam is well appreciated; it is equally well known that the removal of oil from the exhaust steam is necessary, to prevent damage to the boiler, where the exhaust comes in contact with the feed water. The Acme separator is reported equally efficient for the removal of oil from the exhaust steam before it comes in contact with the feed water. For this purpose the separator should be located as near the engine as possible, and before the admixture of steam and feed water. In the case of a condensing plant, a special vacuum pump of small size, or its equivalent, may be required to remove the drip from the separator. In the use of all separators care must be taken to keep the drips open, and ample means must be provided for draining off the discharge from the drip.

INDUSTRIAL NOTES.

Joseph H. Berry, of Detroit, denies that he has purchased the blast furnace of the Weston Furnace Co., of Manistique, but says that he and other Detroit capitalists are interested in a movement to take over the blast furnace and operate it in connection with a chemical plant.

The reorganization of the Rome Iron Co., Rome, Ga., is being advertised, as required by statue in Georgia, and as soon as it can be legally done the reorganization will be formally effected. It is the purpose to have the furnace at Rome in operation in May. L. S. Colyar will be president and general manager.

It is announced that the Empire Steel & Iron Co. has acquired by purchase the entire property of the Crane Iron Works, at Catasauqua, Pa., and the plant of four furnaces will now be operated, together with the Topton Furnace and the two Henry Clay Furnaces at Reading, by the above company. Leonard Peckitt, president of the Crane Iron Works, has accepted the presidency of the Empire Steel & Iron Co.

Furnace No. 1 of the Sloss Iron & Steel Co., Birmingham, is about to blow in.

At the Diamond State Iron Works, Wilmington, Del., extensive improvements are about to be made. Some changes in organization are also pending.

At Reading, Pa., on April 30, the new Keystone Furnace of the Reading Iron Co., was put in blast. The new furnace is the largest plant of its kind in Eastern Pennsylvania. It cost $250,000, and required two years to build. The output is 250 to 300 tons a day.

Merchant & Co., Inc., of Philadelphia, New York and Chicago, report a heavy increase in tin and Babbitt metal business. They have recently, taken among numerous others, a car load order for Babbitt metal from a large western machinery manufacturing Co., the shipment consisting of an assortment of grades. Merchant & Co. have been manufacturing all grades of this metal for a quarter of a century, and their present large business in this line is regarded as testimony to experience and reliability.

Notices have been posted at the blast furnaces of the Mahoning Valley Iron Co., Andrews & Hitchcock Iron Co., Andrews Bros. Co., Brier Hill Iron and Coal Co., Struthers Furnace Co., Ohio Iron & Steel Co., and the Youngstown Steel Co., providing for an advance of 10 per cent in wages on May 1. This applies to turn work and makes the basis $1.80 instead of $1.65. It is the condition of the advance that the men shall work a full turn of 15 days without lay-off.

The deal that has been pending for some time for the lease of Minerva furnace at Milwaukee, has been made. The lessees are W. Aubrey Thomas, of Niles, who has a controlling interest in the enterprise, and Frank Eagle, of Chicago. The plant has not been operated since 1893. It has a capacity of 125 tons a day of foundry iron.

The Dillon-Griswold Wire Co., of Sterling, Ill., posted the following notice last week: "On and after May 1, 1899, the wages of wire drawers, galvanizers, and barbed wire operators will be advanced 10 per cent over our present scale."

Iron and Steel Institute.

The annual meeting of the Iron and Steel Institute will be held in London, May 4 and 5, 1899. The following is a list of papers that are to be read and discussed:

"The Diffusion of Iron," by Prof. J. O. Arnold, and Mr. A. McWilliam, Sheffield.

"The Gellivare Iron Ore Mines," by H. Bauerman, London.

"The Use of Blast Furnace and Coke Oven Gases," by E. Disdier, Bilbao.

"The Wellman Tilting Furnace," by A. P. Head, London.

"The Solution Theory of Iron and Steel," by the Baron H. Jüptner von Jonstorff, Donawitz, Austria.

"Exploring for Iron Ore with the Magnetic Needle," by Prof. H. Louis, Newcastle-on-Tyne.

"Theories and Facts Relating to Cast Iron and Steel," by Bertrand S. Summers, Chicago, Ill.

"The Manufacture of Steel Direct from the Ore in the Blast Furnace," by D. Tschernoff, St. Petersburg.

"The Use of Hot Blast in the Bessemer Process," by Prof. J. Wiborgh, Stockholm.

ODD ROLLING MILL SHAPES.

BY "FERRUM."

A wonderful variety of shapes can be produced in rolling, and besides the shapes which are customarily produced in rolling mills, for definite uses, the company is frequently called upon to roll odd shapes for special purposes, requirng the employment of some special principle.

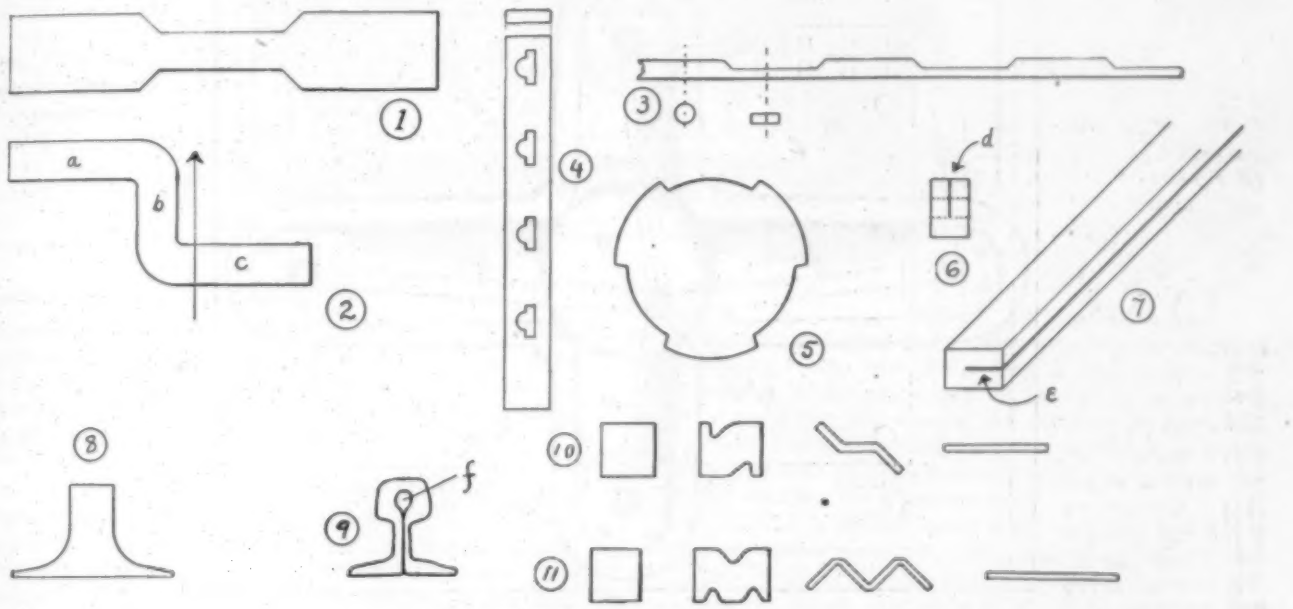
Not all shapes can be rolled, and some forms, which to the layman would seem comparatively simple, cannot be produced at all. An important principle which must always be observed is to equalize the draft on each side so that the metal will go through straight. Every rolling mill has been called upon to produce dozens of special shapes, which were required for some particular purpose, and in which there would be but one customer and, perhaps, but one order. It has come to be a recognized practice that in such cases where the tonnage ordered is below a certain amount the customer is to furnish the rolls at his own expense, the mill then charging for the rolling at a suitable figure. The cost of the rolls may be greater than the cost of the finished material, when the quantity required is not large.

Illustrations are given herewith of a few odd shapes which have been rolled. To produce a flat piece of uniform thickness, and of the shape shown in Fig. 1, had been given up by the management, when an old roller undertook to produce the piece, and he did it on an ordinary sheet mill, the plan being simply to bend a piece in the shape shown in Fig. 2 and roll it in the direction indicated by the arrow, back and forth. The draft, it will be seen, would widen the parts *a* and *c*, and lengthen the part *b*, so that when bent straight again the piece would be in the form shown in Fig. 1. By this plan considerable work and material were saved by its not being necessary to cut out the pieces to make the narrow part in the middle.

Twenty years or so ago there was a form of fence much used, which is shown in Figs. 3 and 4. The rod which was strung from post to post was composed of sections, say 6 inches long, alternately square and flat, the two sections not being concentric, but the flat being all to one side of the center of the round. Fig. 4 shows the post, not drawn to scale. The openings were as shown a combination of a circle and a slot. Now if the piece shown in Fig. 3 were placed so that the round portion projected to the left, it could be drawn through the hole in the post, there being a round opening for the round, and a slot for the flat. But turn the piece half way around, with a round section in the slot, and the piece would be securely locked from transverse motion relative to the post. To produce this rod, an ordinary round was taken, and the flat sections mashed out by a mill, one roll of which had a section as shown in Fig. 5.

A lock nut invented some time ago was of the form shown in Fig. 6, *d* representing a closed slot, which, after the nut was screwed down tight, would be opened up by driving a wedge in, or otherwise, thus locking it on the threads of the bolt. It was desired to cut these nuts from a long bar, having a slit in it, and to saw this slit would have been very expensive, considering the tonnage. The piece required is shown in Fig. 7, *e* indicating the slit. This piece was rolled flat, and the halves brought around to close up, the metal being too cold to weld

In a rail the head is the part subject to wear, and it should preferably be the best part of the rail, but it has not been possible to devise a system whereby it should receive much work, and as rails are rolled, there is scarcely any work done on the head, the web and flange being decidedly tougher than the head, on account of the extra work done on them. It is claimed that no means can be used to increase the work on the head, although such a departure would be a welcome one. The first passes produce a section known as a "dummy rail," shown roughly by Fig. 8. The metal so far has been rolled upright. The rail is then turned and rolled sidewise, and the web formed. An old form of rail was much rolled in England in the days of the iron rail. It is shown in Fig. 9, *f* indicating an empty space. It cannot be stated positively that this was done to economize in material, but the rail was rolled flat to nearly the section desired, and then the halves were brought around, closing up below the space *f*, and leaving this empty. The halves were not welded along the line, because it was not necessary that they should weld, there being no particular strain in this direction. It may be noted that in this form of rail, the rolling had the effect of greatly improving the metal forming the head. "Lateral rolling" has been more or less practiced for many years, and consists in spreading the metal sidewise at the same time that it is rolled lengthwise. There may be an improvement in the quality owing to the working in both directions, or it may be the reverse in the case; the writer does not pretend to say. In rolling charcoal iron, it is not desirable even to roll the material back and forth, as would be done on a three-high mill, or a two-high reversing mill. The skelp from which charcoal iron boiler tubes are made is rolled one way only, the metal being pulled back after each pass, for the next one, the two-high mill, driven in a constant direction being employed. Figs. 10 and 11 show two forms of lateral rolling, which have been more or less employed for a number of years, in England and in this country. The passes are not all represented. Starting with a square billet, in the first case two non-registering grooves are made, one above and the other below and subsequent passes produce a substantially N-shape, the metal being spread laterally. The metal is gradually flattened out until the flat is produced. It is claimed that with this form of rolling the metal fills the corners better and thus the section is more uniform. The principle has been applied to the rolling of sheet and tin plate bars, in which it is very important that the weight per foot shall be as uniform and as near to the ordered weight as possible. Fig. 11 shows an application of the same principle, the intermediate form being M-shaped.



ODD ROLLING MILL SHAPES.

A METHOD OF CASTING STEEL INGOTS.

To overcome the difficulties from segregation and piping and to insure homogeneous metal, a method has been devised J. K. Griffith, of Latrobe, Pa., of casting compound ingots—that is, ingots composed of layers of steel of different composition. The inventor has found in the casting of ingots, particularly large ones, that if in addition to the use of a bottom chill, the gates be located at the sides of the mold cavity, at successively higher levels, or if provision be made otherwise so that the metal shall first flow laterally into the mold at the base and shall then flow laterally there into at the upper gates, constantly at the surface of the metal as the levels of the latter are reached successively by rise of the metal within the mold, the mold being kept free from agitation and the streams of metal caused to enter in different directions, danger of segregation and piping is diminished. Practice has shown, also, that by introducing the metal in lateral streams so as to prevent the later portions of the cast from disturbing the metal first introduced, the formation of a compound ingot having strata of different composition is made easy and practicable. The chilling and solidification extending from the bottom in planes parallel to the face of the chill, there is no opportunity for the contraction of the interior of the metal within a rigid shell, which is the cause of piping. Any defects that may result are at the surface of the ingot and can be planed off readily, if desired. This mode of casting also makes it possible to feed the casting with a much smaller sinking head than it is otherwise necessary to secure good results. It also prevents the formation of surface-cracks caused by the chilling of the sides of the ingot.

By the use of a bottom chill in the making of compound ingots, there is a rapid solidification of the metal first poured, sufficient to preserve its identity; yet it permits the adjacent surfaces of the strata to blend enough to prevent a sharp line of demarkation. The inventor claims that his method will permit of making ingots the face or bottom of which shall be of high carbon grading upwardly into low carbon or softer steel, and which can be forged or rolled into rails, the heads or portions of the heads of which shall be of hard steel and the web and foot of soft steel, armor plates, deck plates, plates for burglar-proof safes, etc., and which can afterward be hardened or tempered by known processes, if desired, and that chromium, tungsten, manganese, nickel or other alloying materials may be introduced into the steel or into the strata thereof.

The construction of the apparatus and the method of operation are thus described by Mr. Griffith. In Figs. 1 and 2, there is represented at 2 the cavity of a mold for casting ingots which is of less depth than width and the bottom of which is constituted by a chill-plate 3, either a heavy metal plate, or, as shown in these figures of the drawings, a plate uniformly and regularly cooled by the passage of water through it or in contact with it, the purpose being that the chill shall be of proper construction to abstract the heat from the bottom of the liquid metal very rapidly by conduction. The conduction of heat is constant and uniform from all parts of the bottom of the ingot until the surface of the ingot is frozen.

Four represents a water channel or passage having an inlet 5 and an outlet 6. This channel is preferably formed by an open pan, within which the plate 3, preferably formed with a corrugated bottom to give greater surface of contact with the water, is set. The sides of the mold-cavity are constituted of fire-brick, fire-clay, sand, or other molding composition contained within a suitable box or flask 7, and there are gates 8 for the entrance of the metal, which are formed in the sides at successively higher levels and which communicate by way of stopper-controlled passages 9 with fountains or basins 10, into which the molten metal may be poured. In casting an ingot in the mold so formed molten steel is poured into the basins 10 and, flowing through the passages 9, enters through the lowest gate or gates 8 into the bottom of the mold, where it is rapidly chilled by contact with the plate 3. When the metal rises above the level of the lowest gate, it

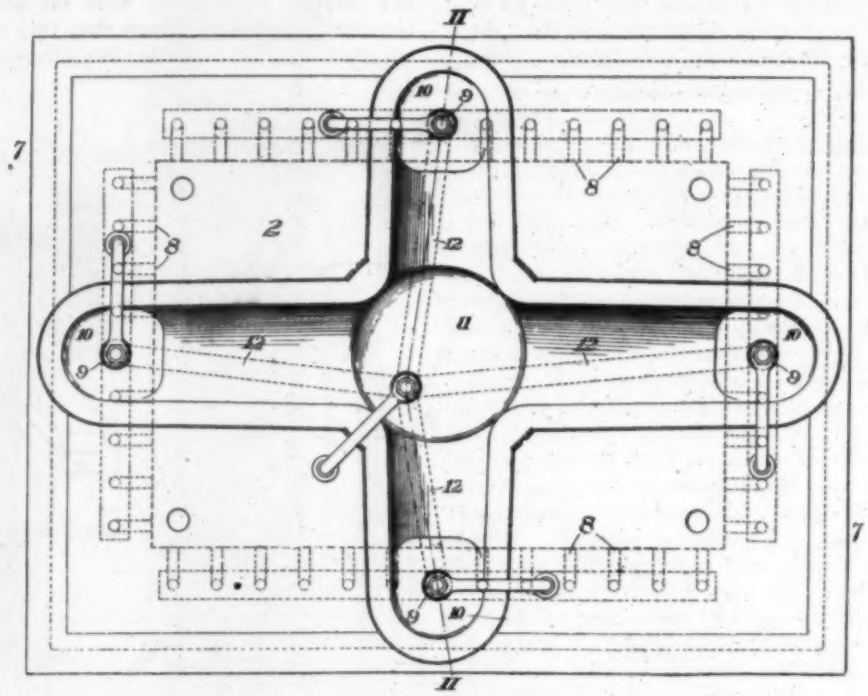


FIG. 1—METHOD OF CASTING STEEL INGOTS.

begins to enter through the gates next above, chilling as it enters by reason of the cooling influence of the plate 3, and so on the metal enters in succession through the gates until the mold has been filled. Instead of forming the gates into the mold-cavity of series of separate openings 8 at different levels they may be constituted by vertical continuous slots 8, with the same result, the difference being simply that all the gates of each vertical series are merged, the metal in both instances entering laterally the base of the mold, and then entering at successively higher levels at the surface of the metal as the same rises.

I show in Figs. 1 and 2 an excellent arrangement for casting steel ingots which may be caused to vary gradually and uniformly in the proportion of carbon or other element which they contain from the face of the ingot to the back. In the middle of the basins 10 I form a second basin 11, having a stopper-controlled discharge communicating through a passage or passages 12 with the passages 9 and having dams separating it from the basins 10, over which the metal can overflow. The first portion of the metal to be cast—say steel having a high percentage of carbon or containing a hardening alloying substance—is poured into the basin 11 and, overflowing into the basin 10, is then discharged into the mold through the passages 9. Additions of softer metal are then made to the metal in the basin 11 until the diluted metal overflows into the basins 10 and is discharged into the mold, and

by successively increasing the proportion of softer metal added to the middle basin a body of metal of gradually-lessening hardness may be introduced through the lateral gates. The contents of the basin 11 may at any time be emptied into the mold through its stopper-controlled opening, and afterward, if desired, a homogeneous softer stratum may be poured therethrough.

Instead of constituting all the strata of the ingot of cast metal I may proceed, as illstrated in Fig. 3, by placing a plate 13, of wrought metal, heated to or above a welding heat, at the bottom of the mold upon the chill and then teeming the fluid metal upon it through the lateral ports, as above described. The wrought plate is held upon and in close contact with the chill by the weight of the superincumbent metal, and the chilling action of the chill is exerted by conduction

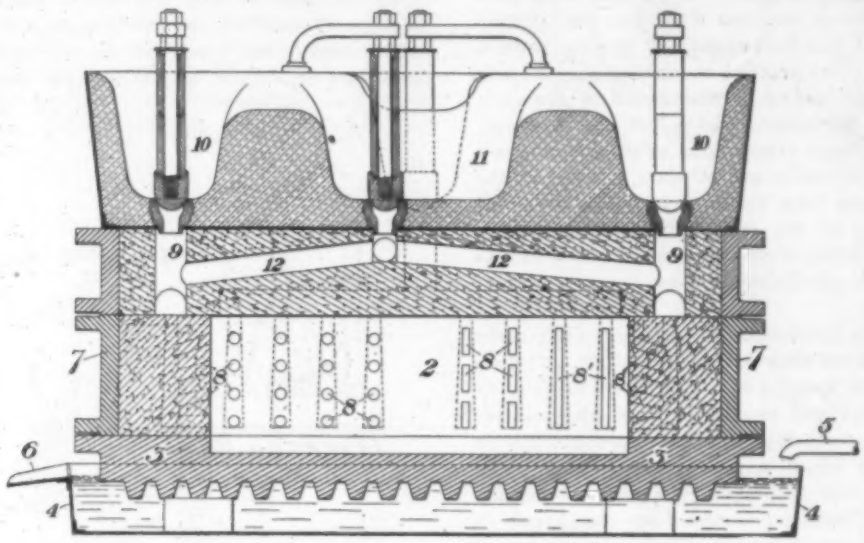


FIG. 2.—METHOD OF CASTING STEEL INGOTS.

through the plate upon the molten metal above. The consequence is that a compound ingot is formed, the cast metal adhering and welding perfectly to the wrought plate and being itself prevented from segregation and piping by the action of the chill.

The Union Malleable Iron Co.

A new plant will be built at East Moline, Ill., by the Union Malleable Iron Co., of Moline. It will be of large size, with an annual capacity of 10,000 tons of malleable castings. The following description of the new establishment has been furnished by the company:

The ground to be occupied has an area of 522x900

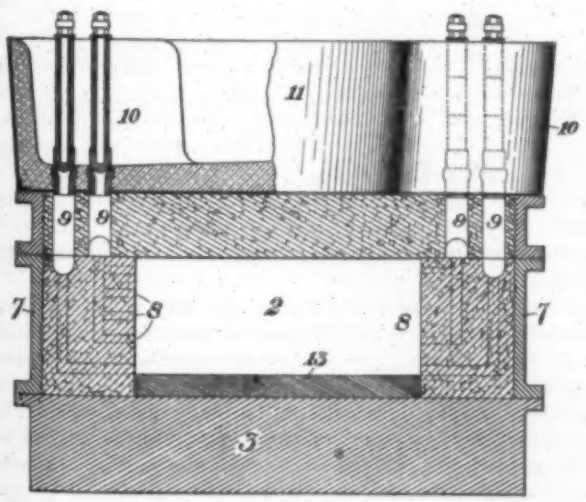


FIG. 3.—METHOD OF CASTING STEEL INGOTS.

feet, and it is situated between the main lines of the C., R. I. & P. and C., B. & Q. A 15-foot roadbed for switches branches off and runs parallel with the main tracks of the two roads. On the extreme west of the buildings is storage room for pig iron, coal yard, etc. Then comes the foundry, with north and south dimensions of 408 feet, and east and west dimensions of 150 feet. A space of 274 feet is left on the south for a future extension of the foundry if necessary. The foundry is connected with the hard mill room by 25-foot gang-ways. The mill room will be 50x80 feet in dimensions, and directly adjoins the assorting room, 40x50 feet in dimensions. Another 25-foot gangway leads to the annealing room, further east, which has dimensions of 100x225 feet. From the annealing room the progress of manufacture leads to the soft mill room, 50x50 feet, just north of and adjoining the annealing room.

Castings which need no machine work will be taken directly to the shipping room, to the northeast side of the plant, and alongside the switch track of the C., B. & Q. This shipping room is 60x204 feet in dimensions. Castings which need machine work will be transferred from the soft assorting room to the machine and blacksmith room, between the shipping and annealing rooms, with dimensions of 50x128 feet. The carpenter and pattern shops will be located in a two-story building, 50x80 feet, and situated just north of the hard mill. The pattern shop will be confined to the second story of the building, and on the ground floor adjoining the building, is a 40x50 foot extension for a pattern vault.

The core room is situated south of the hard mill, and it is to have dimensions of 50x80 feet, with a space of 58 feet for future extension. South of the core room are spaces of 40x50 and 50x80 feet for future extensions of the hard assorting and hard mill, respectively. Then comes the engine room with dimesions of 50x50 feet, and adjoining is the boiler room with like dimensions.

The main office building is to be located just east of the annealing room. It will be two stories in height, with dimensions of 50x60 feet. The time keeper's and superintendent's office, 30x60 feet, is just south of the office, and further on space has been left for a 50x50 foot clothes and wash room for the men, and a 50x50 foot bath room, also for the employes. These last two innovations have not been altogether decided on yet, but Manager F. W. Gould says they will surely be built if the company have enough money left. A 50x50 foot barn is located on the extreme southeast corner of the plant.

The company proposes to do its annealing by gas, and a 30x186-foot space is set apart on the south end for gas producers.

THE Union Steel & Chain Co., has been incorporated by New York parties, under the laws of Delaware, with $60,000,000 capital stock. The charter is taken out in view of the progress of negotiations toward the consolidation of the bulk of the chain manufacturers. The capital stock is half 7 per cent preferred and the balance common. The Pittsburg chain manufacturers, not all of whom have decided to enter the consolidation, are James McKay & Co., Garland Chain Co., Baker Chain & Wagon Mfg. Co., and Jones & Laughlins, Ltd. The first two are building new plants. E. L. Harper & Son, New York, are conducting the negotiations.

QUICK REVOLUTION STEAM ENGINES.—I *

BY ARTHUR HERSCHMANN.

In these days of rapid changes, when novelty of conception and record-breaking proportions of mechanism attract more attention than anything else, one has almost to apologize for reading a paper on the steam engine—a field in which, so it would appear to the layman, no progress has been made since the days of James Watt. Indeed, Watt's condensing engine of 1768, with a coal consumption of 9 lbs. per h. p. per hour, remained unaltered in 1804 when Woolf added his second cylinder, in 1850 when John Edler compounded it, and when the triple expansion engine became introduced in 1870 the coal consumption was only lowered to 1.7 lbs., a figure which we know does not yet represent 15 per cent of the theoretical value of coal burned under the boiler. Since that date little progress has been made to improve economy; the attempt to introduce a system of four-fold expansion having proven, we may say, valueless. The practice of running engines with superheated steam, which had to be abandoned in the early 40's, when Hirn, in Germany, and Clark in England, demonstrated the advantages to be gained by the use of superheated steam, became revived in recent years, favored by the improvements which have been made in packing material, heat resisting, lubicating oil, etc., and characterizes a departure in engine building, which, however, is not as marked as the advent of the quick revolution engine, the type which shall concern us tonight.

It was not until marine practice taught stationary engineers about the possibilities of running well-designed and well-built engines at a high rate of speed, and not before the days of electricity that the high-speed engine became appreciated. Afterward, assisted by contemporaneous improvements in shop practice, the high speed engine came to stay. The requirements of modern competition and the general tendency in all branches of manufacturing to speed up machinery, so as to increase its hourly output, and the desire to economize the space assigned to the power plant, opened up a wide field of application for the high-speed engine, which latter enables one to dispense with intermediate shafting and the frictional losses consistent with its use. To-day the high speed engine is so popular that even in the manufacturing district of Northern England, where still many a new beam engine is being put down, to suit the fancy of Ben, the engineer, or Jim, the mill-wright, the vertical quick running engine is growing in favor as a mill-driving motor. Naturally it has been tried to speed up vertical Corliss engines, but it has been found that the limit for a "trip-gear" is in the neighborhood of 120 revolutions.

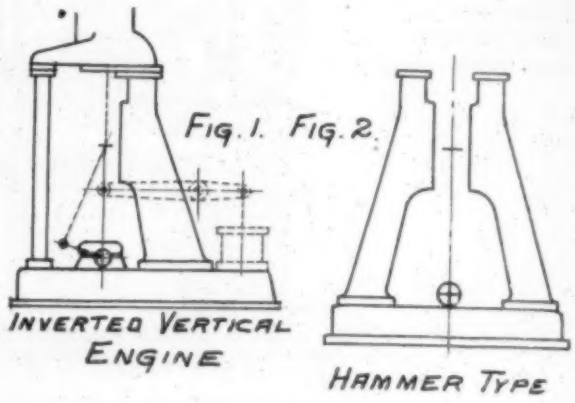
Tracing back the introduction of the high speed engine we find that for a long time it could not gain recognition alongside the Corliss type of engine, which, latter, being then a universal favorite, differed from the former considerably and in the most important details. We know that at that time, when Corliss introduced his engine, there was no other variable expansion gear known which the governor could control as easily and precisely as a Corliss "trip-gear," and that Corliss was ahead of his time with both the design and the workmanship of his engine. Twist valves, piston and drop valves fall in a later period, and the old Meyer gear, like many of its modifications, could not be efficiently negotiated by a sensitive governor, as an efficient gear must not act back on the governor. Economy and good regulation, therefore, secured a monopoly for the Corliss engine, and incidentally the notion spread that nothing but a slow running engine could give good results. Of course, the piston speed, the real measure of speed, is still higher in a slow-running Corliss engine than in most high-speed engines. The characteristic features of the superiority of the Corliss type of engine became, however, less prominent when instead of driving factories having a steady load, small dynamos of varying load had to be driven, (as direct as possible to avoid sluggish governing), and when the frictional loss of mill gearing, once the chief load of many industrial establishments, became reduced through the introduction of the now popular swivel bearing and other improvements in the transmission of motive power. The original Corliss engine, moreover, was not capable of a very wide range of "cut-off."

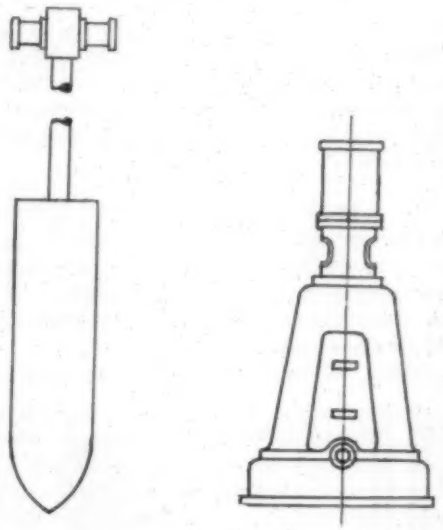
* Read at the meeting of the Engineers Society of Western Pennsylvania, Tuesday evening, April 18, 1899.

To govern quickly and within wide limits we had to have, instead of a very heavy fly-wheel, more impulses on the crank shaft per unit of time. As the variation in the load will cause the governor to affect, at the very best, the next stroke and cut-off only of the engine, it became desirable to shorten this stroke and repeat it proportionately often during a given time.

It may be of interest to state that this evolution of the quick-revolving engine does not seem to have taken place in the different engineering nations at the same time or in the same manner. English engineers, with their large experience in marine practice and with their preference for vertically arranged cylinders, which latter have for a hundred years proven to be a desirable feature with beam engines, developed early the type of engine known as "inverted vertical" or marine type. See Figs. 1 and 2.

In this country the experience in the accurate building of machinery enabled you to demonstrate the fallacy of the belief that great speed per second means great wear and tear, and an engine was developed, characterized by light





moving parts, well balanced, shaft governor and utmost simplicity of design.

In Europe the high speed engine was longest opposed and considered an absurdity. The reasons for this are not far to seek. In the first place, electrical machinery was run at lower speeds and the tendency there was and is to build large and slow-running dynamos, and match the speed of the engine, whilst in this country and in England the engine became speeded up to match the dynamo speed. Secondly, scientific considerations and theory, however useful in general as a guide and telling us what we should not attempt to do, are deluding in this case and against the high-speed engine. Theory and precedence being more regarded there than in this country, the features of short stroke, small expansion and large clearance sentenced this engine. As a passing remark we may state here that clearance which averages 15 per cent, reaching as much as 25 per cent, will seldom be found excessive, being essential to cushion the engine. It is

now more generally understood that in every engine the economical limit of expansion is sooner reached than its possible theoretical degree, owing to increase of heat—and friction—losses in larger cylnders, and that here Lord Kelvin's law of economy, defining the relation of increment of capital to advantages to be derived from such additional expense, should, as in so many engineering problems, receive first attention. It should also be considered that it makes no difference to the user of an engine whether he pays with his money for coal or for capital charges and that with this commercial end in view, speed, gear or type of engine are subordinate considerations.

At the recent exhibition of Brussels, Belgium, I saw so-called "improved" Corliss engines, representative of the taste of the French and Belgian designer. It seemed to me that they were too perfect to be entrusted to the care of, imperfect human attendants and that they had too many rods, joints and packing boxes. A quick-revolving engine, on the other hand, would be simple, reliable and have all the moving parts accessible and quickly renewable. After this somewhat historic review, I should like to consider the present practice and then discuss the merits of a few representative types of quick-running engines. The subject is very large and to-

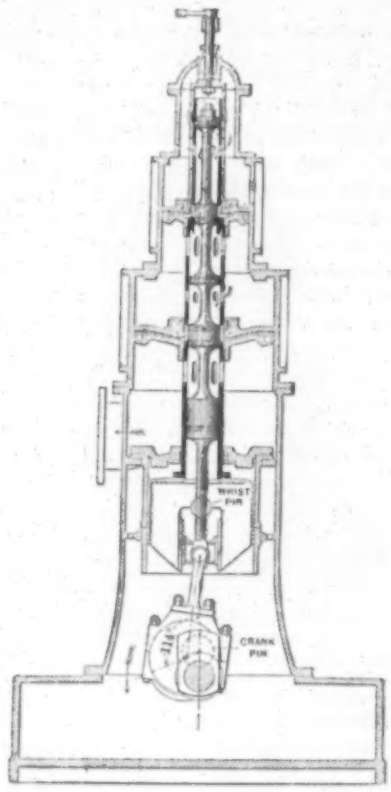


FIG. 4.—WILLANS HIGH SPEED ENGINE.

night we can only describe a few engines. I shall not consider rotary engines or turbines, and shall restrict myself to engines in England and on the continent of Europe, thinking that such information will be of most interest to you.

In this country of cheap fuel, generally speaking you find the non-condensing type of engine to prevail and in particular where the water is dear; in Europe condensers are insisted upon, wherever it is possible to install them. Preferably the driving of these condensers, or their air pumps, is effected direct from the cross head of the engine, (see Fig. 1) and this tendency has developed the so-called high speed engine there, running at 150 revolutions or thereabouts. The air pump in such engines is single acting and often a cigar shaped plunger (see Fig. 3). I think Franco Tosi, a large engine builder in Italy, was among the first to build an engine on the liens of the Armington-Simms engine, but with an independent belt driven condenser, situated beneath the engine. The modern tendency is to use direct acting air pumps and to connect all the exhaust pipes of a plant to a central condensing station.

A point which cannot escape the attention of the observer is that single acting engines are not in favor in Europe, though they should appeal to the theoretical designer. High speed engines with rotary valves, arranged similar to those of the English Brotherhood engine, are being manufactured in some quarters, but they have few advocates I saw one engine of this type at Liege, Belgium, having rotating valves arranged vertically, and therefore less liable to wear; this engine was very simple and showed good results.

Concerning the action of the steam, we find that although the single acting engine preceded the double acting, the former has only in recent years become a prominent type.

A single acting engine is not liable to knock if properly cushioned; there is only a downward thrust and the direction of the strain in the moving parts is not changing from tension

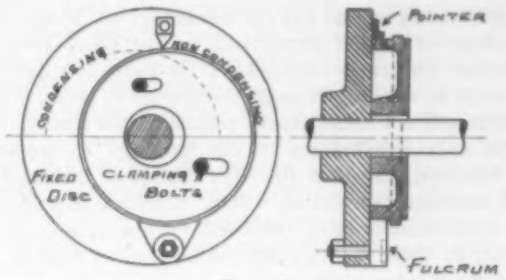


Fig. 5.

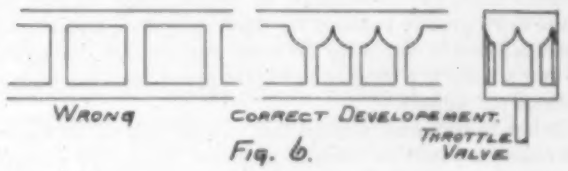


Fig. 6.

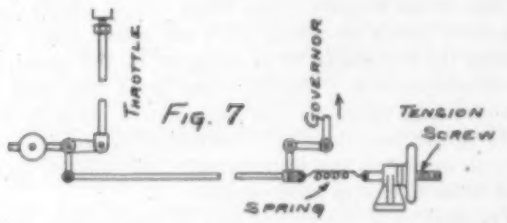


Fig. 7

to compression as in double acting engines. It is frequently pointed out that this very quality will prevent a good lubrication of the brasses, but experience has sufficiently demonstrated the fallacy of this contention in all cases where the bearings are not skimped down in their surface. As a rule the designer will find that on account of the large cylinders required for the single action, the centers of the two adjoining sets of engines will have to be far enough apart to allow

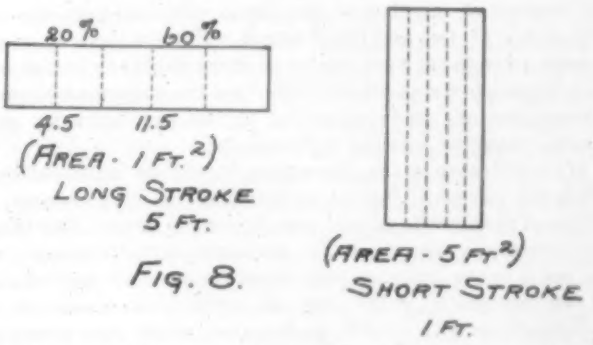


Fig. 8.

of ample provision being made for the bearings. The "Willans" engine, (see Fig. 4), built at Rugby, England, is the most popular engine of this type in England, it is enclosed and splash-lubricating like the Westinghouse engine and has many good features in its design. The engine has a central valve located inside the hollow piston rod, the cut-off is effected by the piston rod and therefore very rapidly at piston speed. There is only one joint in the driving gear of the piston valve, and the engine is very compact and can to a great extent be built on a lathe.

Compound high speed engines are the rule, at least for electrical purposes, and they are built with two orthree cranks, or what is the same thing, two or three sets of cylinders.

If run non-condensing, it is customary to fix on a suitable cut-off and govern with a throttle governor in preference to regulating with an automatic expansion gear, which latter is apt to cause a drag in the large low pressure cylinder at light loads, cutting off early. Where it is the intention to run the engine periodically condensing, say when there is amplewater to be had or during summer time only, when the exhaust has not to heat the shop, it is advisable to hang the eccentrics on fixed discs and to make them adjustable so that they can be readily thrown over to vary the required "cut-off." (See Fig. 5.) A pointer arrangement serves in such cases to indicate the position of the eccentrics. An engine of this description which has proven very useful is shown in one of the photos.

The double acting engine has the advantage of being, generally speaking, of smaller proportions, and of being reversible should this feature be desired. It is here only just to state that even at very high speeds the change of stress in the moving parts will not cause knock or show undue wear if the steps in the rods and brasses in the bearings be properly fitted and adjusted, and that this very change of direction of stress will facilitate lubrication. With pressure lubrication which we shall consider later, there will be always a quantity of oil ready to force its way into the brasses, as soon as the reversal of stress takes place.

As regards the number of revolutions, 5-600 is the maximum with small English engines, whilst Continental types will seldom reach 300 revolutions; of course these figures would have to be greatly reduced for heavy engines, and I think for instance that it would for different reasons not be advisable to run a 1,000 h. p. engine at higher speed than say 1-200 revolutions per minute.

It has to be borne in mind that in speeding up an engine we increase its power in a linear measure while the centrifugal strain, caused by the inertia of the moving parts, grows with the square of the velocity. The latter strain affects the moving parts for which we cannot allow too much space without sacrificing the first object to be aimed at in the construction, which is compactness. Naturally the price will also go up with a very high speed, as the design will have to be one embodying the best details of construction, and the material employed, as well as the workmanship, will have to be of the highest order to ensure good results.

The regulation of the engine and in connection therewith the selection of a suitable valve gear is a subject on which opinions differ very greatly. In the case of an electric light engine for instance, it used to be customary to specify that the governor should keep the engine within a speed variation of as low as ½ per cent between full load and running empty; later it became understood that this close governing was not as important as it first seemed to be, in fact dynamos began to take care of themselves and their output electrically, (winding of dynamos) and more importance was attached to the even running of the engine which was insured by increasing the number of impulses on the crank-shaft through the arrangement of two and three sets of cylinders and as many cranks arranged at right angles or at 120 degrees. It is a common experience with electric light that the constant and small fluctuations are more annoying to the eye than the slow waves, changing between light and dark.

With reference to the governing, it will be observed that while the automatic feature is prevalent in this country, in England the throttle governor is growing in favor. The throttle is hardly as sensitive as the automatic valve, however close we put it to the cylinder, and its action is not as rapid as that of an automatic valve, but as before discussed, it is sufficiently so with a multicrank engine, which type of engine prevails on the other side of the ocean. In any case the throttle valve proper should have a correct development, (see Fig. 6), a point which is not always watched. As regards economy, throttle governing gives excellent results for steady loads, whilst in cases where a great variation of load has to be met, we are compelled to set the gear and fix the eccentric for the latest "cut-off" and the maximal load, or rather for the load which is likely to occur most of the time, so that the engine will run less satisfactorily at light loads. Where we have a low steam pressure, this disadvantage of throttling decreases, though in any case throttling means that the exhaust will carry away more of the heat because the maximum pressure has extended over a comparatively large part of the stroke. The latter loss increases percentually as the work of the engine decreases.

The automatic engine on the other hand has the disadvantage that the maximal pressure always occurs at one end only, so that there is a great difference in the energy card of such an engine, necessitating the use of larger parts; increase of expense will result as well as increase of friction since we have to use a large fly-wheel to enable us to work with great expansion and a drag at light loads may also occur if cylinders are too large. As an advantage of the automatic engine could be mentioned that it will not allow the engine to run away when the load is suddenly thrown off, since the governor when reducing the "cut-off" will automatically increase the compression and thereby pull up the engine, whilst with throttle governing when the throttle valve is leaky there is in certain types of engine a chance that sufficient steam reaches the cylinders to keep the engine racing. It should be said that the automatic feature is a safeguard in this respect only where a single valve is employed, controlling the compression as well as the admission, as there are most engines, particularly those having two cylinders, in which two separate valves are arranged and in which the distributing valve is not affected by the governor. Whether in the case of the throttle or the automatic engine, the shaft governor is being universally employed; it dispenses with troublesome intermediate gearing to run the governor, and makes the engine more safe, sensitive and compact. In many designs the "governing center," as it were, of the engine can be altered at will by means of an attachment at the side of the fly-wheel governor. It consists of a hand wheel and screw externally arranged and acting on the tension of the governor springs, or affecting the leverage of the centrifugal weights. In the case of throttle governing such a speeding device is very simply produced by interposing a spring and tension screw between governor and throttle. This appears in Fig. 7.

As bearing on the economy of quick-running engines we shall consider the ratio of diameter and stroke and how it affects the amount of "cut-off" to be employed. For a given horse power and piston speed, we assume for the sake of comparison that in one case we have a long stroke engine, one square foot piston area and five foot stroke, and compare this with a quick-running engine, of five square foot piston area and one foot stroke. At 20 per cent cut-off we find the surfaces exposed to condensing action of the steam to be four and one-half square feet for the long stroke and 13 for the short stroke, but at 60 per cent we find this surface to be 11½ square feet in the first instance and only 10 square feet in the case of the quick-running engine. See Fig. 8.

We find, generally speaking, that both types have same piston speed, but that the short stroke engine makes four times the number of revolutions of the long stroke engine, therefore there is less time for the condensation of steam to take place. Of course this calculation would not be correct if we considered the large port surfaces of small engines. In any case we see that quick-running engines should have a large cut-off and that there is not much use for "jacketing," an arrangement which is very generally used in Europe. It is, on the other hand, only logical that we should cut off as early as the load will permit, but this would in long cylinders, as we have just seen, give great loss from condensation.

Much could be said about good features in the general design of high speed engines, but I shall only briefly touch a few.

Whilst horizontal engines are the rule in this country, the vertical inverted type now prevails on the other side; the frame of this engine consisting generally of a cast iron standard, accommodating the crosshead guide, the front being as a rule made more accessible by letting the cylinder rest on one or two wrought iron or steel columns, respectively, three in the case of a two-crank engine, or four in the case of three cranks. The early types are of the hammer pattern, (shown in Fig. 2), having standards in front and back which enables them to be more reversible, should it be necessary.

The tendency is to enclose the running parts within a surrounding and oil-tight frame, (see Fig. 2A), access through which latter can be gained by removing suitable covers or opening regular doors, provided in same, which arrangement is indispensible in the case of forced lubrication, which popular lubrication we shall consider presently. Soft packings are still largely used, but the metallic packing is never disregarded where good work is concerned. A cheap substitute for a packing can occasionally be met in high speed engines, (mostly to separate the low pressure cylinder from the high pressure in tandem engines), which consists of a plain bushing with a few narrow grooves turned on the inside to act as steam cataracts.

(To be continued.)

DEATH OF CAPTAIN ALFRED E. HUNT.

It would be very difficult to say in what way Capt. Alfred E. Hunt, whose untimely death last Wednesday has been lamented on both sides of the ocean, was best known—as the captain of the famous "Hampton Battery B" of the National Guard of Pennsylvania, as the founder and senior member of the Pittsburg Testing Laboratory, a foremost institution of its kind; as the president and organizer of the Pittsburg Reduction Co., which has made aluminum a commercial metal; or simply as a wonderfully energetic, enthusiastic and capable engineer, metallurgist and business man.

Capt. Hunt was born in East Douglass, Mass., in 1855. He was 44 years of age when he died. On his father's side he belonged to the eighth generation descended from William Hunt, who came from Salisbury, Eng., in 1635, and became one of the original settlers of Concord, Mass. His paternal grandfather founded the works in Douglass, Mass., where the famous Hunt's axes were manufactured. On his mother's side his ancestry is traceable directly back to the Rev. Peter Thatcher, rector of St. Edmond's church, Salisbury, Eng.

Capt. Hunt received his education at the Boston high school and at the Massachusetts Institute of Technology, receiving from the latter institution on his graduation in 1876, the degree of bachelor of science in the department of metallurgy and mining engineering. After serving for some time with the government geographical survey, and with private engineering corps making topographical and railroad surveys in the West, he became connected with the Bay State

Iron Works, in South Boston, where the second open hearth steel furnace in the country was erected. At the suggestion of Ralph Crooker, Sr., general manager of the concern, he was sent to Michigan to explore for iron ore. Based on his invesitgations and analyses of the samples collected, the report was made on the well known Michigamme deposits. Later he became manager and chemist at the open-hearth steel works in Nashua, N. H.

It was as early as 1879 only three years after his graduation, that Capt. Hunt came to Pittsburg. Serving for a time as chemist and foreman of the heavy hammer department at the Black Diamond Steel Works, now owned by the Park Steel Co., he, in 1882, joined with George H. Clapp, of the same firm, and organized the firm of Hunt & Clapp, operating the Pittsburg Testing Laboratory, for the chemical and physical investigation of materials and the inspection of iron and steel. The concern has become very widely known in these connections, and has inspected and passed upon many of the most important steel structures in the country. In 1893 the business was reorganized into a limited partnership, styled the Pittsburg Testing Laboratory, Ltd. At the time of his death Capt. Hunt was vice-chairman, George H. Clapp being chairman.

In 1888 Capt. Hunt organized the Pittsburg Reduction Co., to manufacture aluminum under the process of Chas. M. Hall, who had been connected with the Pittsburg Testing Laboratory. He has been president of the company ever since. For some years the company was engaged in important litigation respecting the exclusive rights of the Hall process in the United States, which rights were thoroughly established. His policy was to reduce in every possible way the cost of manufacture and give the public the largest possible share in the economies effected, so as to increase the use of the metal. At the same time he busied himself in a campaign of education covering the varied and extensive uses to which aluminum may be put. When the reduction company was formed, aluminum cost about $15 a pound. In large lots, the No. 1 grade, having less than one-half per cent of impurities, now sells for 33 cents a pound, it being cheaper than brass, bulk for bulk, and much cheaper than copper, compared by the same standard.

Capt. Hunt derived his title from having been commander of Battery B., N. G. P., for over 12 years. At Mt. Gretna, Pennsylvania, he volunteered into the national service. While the battery was in camp at Chichamauga he was invalided home, but while not recovered he joined the battery to go to Porto Rico. His battery had met with its first resistance, and was just on the point of firing its first shot, when a messenger arrived bearing news of the signing of the protocol. While in Porto Rico the captain was taken with malaria, and although after his return he professed to be almost recovered, on the advice of his physician he started Sunday, April 23 for Atlantic City, but was taken ill in Philadelphia, where he died on Wednesday.

In 1878 Capt. Hunt married Miss Maria T. McQueston, of Nashua, N. H. He is survived by her and their son, Roy A. Hunt. His brother, Herbert Hunt, is president of the Hunt Air Brake Co., of New Kensington, Pa. Capt. Hunt was a member and director in the Pittsburg Chamber of Commerce, and a member of numerous technical societies: American Institute of Mining Engineers, American Society for the Advancement of Science, American Society of the Civil Engineers, American Society of Mechanical Engineers, American Chemical Society, Engineers' Society of Western Pennsylvania, of which he was a past president, and the Iron and Steel Institute and the Institute of Engineers, of Great Britain. He was the author of many valuable papers. In 1894 he was awarded the Norman gold medal for the best paper on an engineering topic at the Columbian Exposition competition, his paper being entitled "A Proposed Method Testing Structural Steel."

The feature of Capt. Hunt's disposition which most impressed one was his energy and enthusiasm. He was a very hard worker, of that class of hard workers who are not tied down to one subject and who work hard only because they love that one thing. He was very approachable, and very ready to help those who came to him. His acquaintance was naturally very large. When in Europe his traveling friends would be in a state of continual surprise over the number of acquaintance he would meet, and would be equally surprised at his way, in meeting people for the first time, of always having some special topic for each person which he wished to discuss.

THE program for operation at the Conneaut docks of the Pittsburg, Bessemer & Lake Erie road the coming season provides for night as well as day operation. Two shifts will be organized, so that the unloading of ore will go on continuously. Another feature that will insure dispatch to vessels is the building of steel ore bins, on the west side of the river, in connection with the McMyler fast unloading plant. In case the car supply should not be sufficient to take all of a cargo direct, the vessel and the unloading machines will be moved along opposite the system of bins and the balance of the cargo unloaded into the latter. From the bins it can be dropped into cars when the latter area vailable, the operation saving the slower and more expensive process of unloading such ore as cannot go immediately into cars, upon stock piles from which it must be picked up again for shipment to the furnace.

THE plans to unite the interests of the country making ornamental iron work, dropped some months ago, are being revived, and efforts are being put forth to combine all the manufacturers of ornamental iron work, the scheme being promoted by a New York firm of organizers and underwriters. The following manufacturers are mentioned as being interested in the negotiations: Robert Vierling, William Currer and Erastus Foote, of Chicago; William R. Snead, of Louisville; W. H. Brown, of Indianapolis, and William S. Simpson, of St. Louis.

BLAST FURNACE TUYERES.

The latest installments of the transactions of the American Institute of Mining Engineers contain contributions to the discussions on "Tuyeres in the Iron Blast Furnace," started at the Buffalo meeting of the Institute in October, 1898. Dr. R. W. Raymond, secretary of the Institute discusses the subject as follows:

"In connection with the subject of multiple tuyeres, my attention has been drawn to the practicability of gaining, without the multiplication of tuyeres, the advantages which that measure is intended to secure; and learning that this had been attempted in the invention of the Gaines radial-discharge or fan-shaped tuyere, I wrote to Messrs. Gustafson Brothers, of Sequachee, Tenn., who manufacture that tuyere, for information concerning the invention itself and its performance in practice. To their courtesy I am indebted for most of the facts given below. I present these statements without expressing any personal opinion on the subject (having no personal knowledge of it) for the purpose of bringing this device to the notice of members, and calling forth both criticism and testimony concerning it.

"Admitting that definite advantages are to be secured by the multiplication of tuyeres, we must still confess that this change involves considerable expense in the increased number of blast pipes, tuyeres, coolers, connecions, and pipes for water circulation. There is, moreover, a serious question indvolve in the weakening of the furnace wall by extra perforations. This consideration applies with special force to furnaces already built without reference to such an increase of tuyere-openings. Ledebur, in his *Handbuch der Eisenhüttenkunde*, says on this point (I translate from the edition of 1893, page 365):

"A limit to increase in the number of tuyers is given, in any case, by the circumstance that the perforation of the wall weakens it; in other words, that there must be left between the tuyeres a mass of masonry sufficient to carry the parts above. In most cases an appropriate number may be secured by giving to the furnace as many openings as there are meters in its circumference at the tuyere-level. For instance, for a hearth-diameter of 2.5 meters, i. e., a circumference of 7.7 meters, seven or eight openings might be made, of which, however, one would be occupied, not by a tuyere, but by the fore-hearth or the closed front with cinder-notch.

"Obviously, any device which would produce the same effect as the multiplication of tuyeres without requiring change in the existing equipment or additional perforation of walls would be highly acceptable, especially to the managers of furnaces already built. This is what is claimed for the Gaines tuyere. Figs. 1 and 2 giving back and side views of this tuyere, explain themselves. Its essential feature is the horizontally elongated discharge-opening, which speads the blast in a horizontal fan shaped layer (something like the flame of a gas-burner), instead of delivering it in a cylindrical or conical form.

"But the delivery of the blast with radial impulse in a horizontal plane is not the only result sought by this device. If that were the case, the delivery-opening might be simply a slit, as it is in the ordinary gas-burner, to which this tuyere has been compared. It will be observed, however, in the figures herewith given, that the opening varies regularly in vertical diameter, presenting at no point a perfect parallelism of top and bottom. This peculiar symmetrical form is declared to be the result of calculation and experiment, and to effect the end for which it is designed, namely, the delivery, at each point of the nozzle opening, of a volume of blast proportional to the field of furnace area to be supplied by the radial blast current from that point. The field for each tuyere is taken to be a triangular section of the furnace area at tuyere level, bounded by radii drawn to the center of the area, midway between the tuyere and its adjacent neighbors; and the field for each special portion of nozzle-delivery (say one inch of the horizontal length of nozzle-opening) is taken to be the triangle formed by radii from the nozzle-center, termination at the boundaries, thus determined, of the total field for that tuyere. In other words, the problem is treated as if the circular furnace-area at tuyere-level, were divided into sectors by impermeable partitions, and each tuyere were required to furnish blast for its particular sector; each sector, moreover, being similarly subdivided into triangles having their common apex, not at the center of the furnace, but at the center of the nozzle, and each horizontal inch of the nozzle-opening being required to furnish blast for its own triangle of sector-area. Obviously, the section of blast issuing from the middle of the nozzle slit will have to supply a field extending to the center of the furnace, while the sections on both sides of it will have to serve fields of diminished area, limited by the boundaries of the sectors served by adjacent tuyeres. Hence the nozzle-opening must have a maximum vertical diameter in the missle of its horizontal length—and in like manner the vertical dimension is determtned for each part of that opening, due regard being had to the frictional effect of smaller diameters, to the effect of the residual area along the furnace-walls (not directly supplied with blast, yet taking it, all the same), and to other conditions of practice. The result of a due consideration of all these elements is declared to be the form of nozzle-opening adopted in the Gaines tuyere; and this form, it is claimed, need not be carried in practice, provided the suitable size be used, that is, provided the proper relation between total tuyere-area and hearth-area be observed.

"This proposition seems to me worthy of some further consideration. As a matter of fact, there are no such impermeable partitions between or within the sectors of hearth-area as the theory of the Gaines tuyere assumes. The normal result of the blast from the tuyeres is the production of a general *plenum* of pressure throughout the stock; and, under this pressure, the blast and the resultant gases are supposed to penetrate to all parts of the descending column of stock. Such a normal distribution is often defeated by irregularities in the stock itself, furnishing channels of superior ease tot heascend-

FIG. 1.

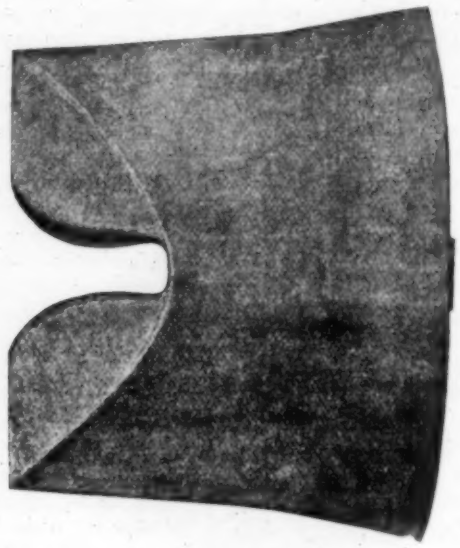


FIG. 2.

GAINES BLAST FURNACE TUYERE.

ing gases, and thus giving rise to premature fusions, accretions, etc. But these evils originate above the tuyere-zone, and how much they depend upon the original distribution of blast is an open question. It might be argued that if the blast be strong enough to penetrate to the center of the hearth, it will certainly distribute itself with sufficient uniformity to penetrate all available openings in the column above. And it might be added that the accretions on the hearth-wall between tuyeres, due to the failure of the blast from ordinary nozzles to reach that space, do no particular harm. The shape assumed by the crucible, from tuyere-level down, is of little consequence, so long as the interior space remains large enough to hold the molten iron, and does not become so large as to permit the iron to break through the weakened walls.

"On the other hand, the establishment of a general interior pressure, such as our ordinary practice assumes, must certainly be the result of mutual reactions and adjustments concerning which we have no data. We do not know, in particular, how long it takes to establish this general equalization of pressure, or how far above the tuyeres it is established. There can be no doubt that by introducing blast through circular openings we create an irregular distribution which must be left to adjust itself somehow according to pneumatic laws. It is unscientific to assume that this adjustment will take place without affecting at all the working of the blast furnace, and that, while recognizing the importance of the distribution of stock, we can ignore entirely the distribution of blast. And it is quite reasonable to suppose that, by introducing the blast in such a manner as to reduce to a minimum the necessary general equalization of interior pressure in the furnace, we may be able to remove one cause (whether it be a principal or only a subordinate one) of irregularities in furnace work.

"These considerations are as applicable to the proposition of increasing the number of tuyeres as to the particular device to which I am calling attention. I would only say, in this connection, that if it be sought to secure the effect of multiplied tuyeres by modifying the form of the nozzle, without increasing the number of tuyeres, I know of no better way to determine the form of nozzle required than that which Mr. Gaines has adopted, notwithstanding the fact that it involves an arbitrary assumption as to the interior subdivisions and conditions of the furnace.

"With regard to both propositions—that of more numerous tuyeres and that of modified nozzle-forms—I may be permitted to express the opinion that, while they are entirely reasonable in theory, their quantitative value must be determined in actual commercial practice. This statement is so true as to both, concerning all new inventions or improvements; but I think it derives some special force, in this instance, from the fact that the evils which it is sought to remedy are not wholly (perhaps not even chiefly,) due to the cause which it is proposed to remove. It follows, moreover, that the verdict of practice itself may be slow in coming, and lacking in unanimity or conclusiveness when it comes, and may require much critical scrutiny and valuation to fix its real scope and weight. For myself, I should not be surprised if these proposed improvements should ultimately turn out to be real, but much less important commercially than their advocates have imagined.

"Let it not be inferred, however, that these or any other inventions are to be, on that ground, condemned. So far as human foresight goes, the day of revolutionary improvements in the production of iron and steel is past. We must look henceforward to small economies, rejoicing as much over a dime as we used to rejoice over a dollar, and valuing every small new gain as turfmen value the fraction of a second in racing-record. Times of low prices and fierce competition, like the present, emphasize the value of technical improvements, which, in the rush of general and ampleprosperity, are despised or neglected. Moreover, I venture to point out that, in these days, the inventions (and also the improvements in the details of practice, which have, not infrequently, more real importance than formally announced "inventions," though they be not ranked as such) cannot be, as a rule thoroughly tested and accurately valued at one place, and under one set of conditions. A comparison of the results obtained under varied conditions is essential to a reliable conclusion."

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

New York capitalists have secured a charter for the Richmond, Va., Standard Steel Spike & Iron Co. Capital $2,000,000, formed for mining coal and iron ore, converting coal into coke, iron ore into pig iron, and pig iron into steel; alo for the manufacture of railroad spikes and all other articles of iron and steel. The officers for the first year are: President, JFred Piersen, Jr., of New York; vice-president, Corbin Warwick, of Richmond; secretary, George M. Bailey, of New York city; treasurer, William H. Llewellyn, of New York city.

At Frankfort, Ky., the Louisville Forge Co. has filed articles of incorporation. Capital, $25,000. J. K. Stewart is the chief incorporator.

The Yantacaw Chemical Engine Co., with principal office at Nutley, N. J., has been incorporated, with a capital of $125,000, for the manufacture of chemical engines, fire extinguishers, etc. The incorporators are A. H. Van Riper, P. F. Guthrie, and Alfred F. Skinner.

The Graef Motor Works, of Brooklyn, N. Y., have been incorporated with a capital of $250,000, by E. W. Graef, E. L. Graef, H. A. Gubnor, George Rekstein, and J. C. Church.

Warrior Iron Works, C. J. Goehegan, manager, Birmingham, Ala., are in the market for an air compressor having air cylinders of about 24-inch diameter.

Dibrell Bros., Danville, Va., want price on a 100 h. p. boiler and a 50 h. p. engine.

The Ross-Meehan Foundry Co., Chattanooga, Tenn., will put in a new engine.

W. H. Crowe, Jellico, Tenn., wants to purchase machinery for foundry and machine shop.

New Construction:—

The East Lebanon Iron Co.'s mill at Lebanon, Pa., recently burned, is to be rebuilt, and it is expected the plant will be in operation the latter part of May. It was the intention to erect steel frame work, but the contract for the steel could not be placed for delivery short of two or three months.

At Huntsville, Ala., D. L. Foster, J. B. Boyd, and others, have organized a company to build and operate a machine shop. An expensive brick building will be erected.

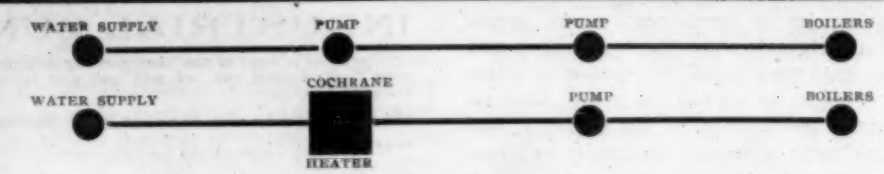
Work has begun on the mammoth repair and car building shop to be erected this season by the Rock Island Road in Valley Junction, Ia. It will be 400x210 feet.

The blast furnace department of Frank C. Roberts & Co., of Philadelphia, is engaged upon the following: The new furnace plant for Laughlin & Co., Ltd., of Pittsburg, of which two furnaces are now under construction; two furnaces for the the Lorain Steel Co., at Lorain, O., both of which are nearly completed; one furnace for the Lebanon Furnaces at Lebanon, Pa., which is also approaching completion, and one furnace for the Riverside Iron Works, at Wheeling, West Va. All of these furnaces will be 100 feet high. In its architectural department the firm is engaged upon contracts as follows: The 17-story office building for the Real Estate Trust Co., of Philadelphia, and a 17-story office building for J. Wallace Hallowell, to be located on Broad st., Philadelphia. It is also working upon the new general store house for the Lehigh Valley Railroad at Packerton, Pa., and the power plant for the shops of the same company at Sayre, Pa.

The Variety Machine Co.'s plant at Warsaw, N. Y., is to be enlarged. The company's capital has been increased to $50,000.

The L. S. Starrett Co., Athol, Mass., having outgrown their present plant, consisting of a three-story and basement building, 240x40 feet, with an annex 72x44 feet, and still needing more room and power, have bought property across the street from their works, with water power, and will utilize it to further expand their business. The main building of this newly acquired property is 130x30 feet, with ell 34x40 feet, four stories high; two separate buildings, 52x30 feet, two stories and a storehouse. A nickel plating plant will be installed in one of the 52x30 foot buildings.

Contracts have just been let for extensive improvements at the Waukesha Malleable Iron Works, Milwaukee. Two new



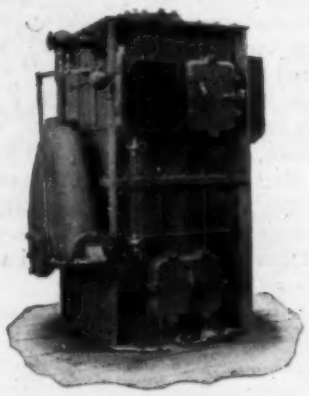
Pumping through, instead of from, a feed-water heater.

Method No. 1: The Pump draws or receives the water intended for the boilers in its original condition: that is, cold, and with all its impurities. The pump then forces (against the pressure in the boiler, and against the friction) this water into the Heater; the pump does not stop pushing the water so long as it is in operation, and it also pushes along all the mud, organic matter, etc. The Heater IS PART OF THE PIPE LINE to the boilers—the water must keep moving through it—and so must the mud. The carbonates of lime and magnesia become insoluble, that is, they are precipitated when the carbonic acid gas is DRIVEN OFF by the heat of exhaust steam, but there is little or no chance within a closed or pressure heater for these gases to free themselves, and so the carbonates in solution pass on through the heater into the boilers, where the gases can get away from the water the same as the steam does, and then precipitation and deposit occur.

Absolutely no purification obtainable with this type of heater, except when the water comes to rest, which occurs only when the plant is shut down.

Method No. 2: The gases liberated by the heat of the exhaust are free to find their way to the atmosphere, for the "COCHRANE" HEATER is an "Open Heater," therefore the carbonates have a chance to form in flaky or solid particles, and it is only a question of providing a suitable lodging place for them, as well as for the mud —— tray surface, settling chamber and a filter bed in the COCHRANE HEATERS.

The exhaust steam condensed in heating the water amounts to say 1-6th or 1-7th of the total supply. This is saved and used, being mixed with the other water. No scale forming matter whatever in this condensed steam.



The Heater in Method No. 2 has to carry less than one pound of pressure—the Heater in case No. 1 must be built to carry boiler pressure, and, therefore, it is heir to all the ills of boilers - expansion and contraction strains, leaky joints, etc.

Is there any question as to which is the preferable system to adopt? We have hundreds of thousands of horse power of COCHRANE HEATERS, proving that Method No. 1 can not "ho'd a candle" to Method No. 2, though this we would like to have you prove for yourself by installing one of our COCHRANE OPEN HEATERS. We send them on trial.

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oven will be constructed and also a fire proof vault in which to keep patterns. There will be two new buildings, one 64x70 and the other 32 feet square. The proposed improvements will cost between $9,000 and $10,000.

Fires and Accidents:—

At Lorain, O., the dam of the blast furnace plant reservoir of the Lorain Steel Co., burst Saturday night, and the pump house was carried into the river. The damage is about $10,000. Some weeks will be required to rebuild the dam, but meantime water can be piped to the furnace from the steel plant reservoir, and the delay in starting these will be about two weeks.

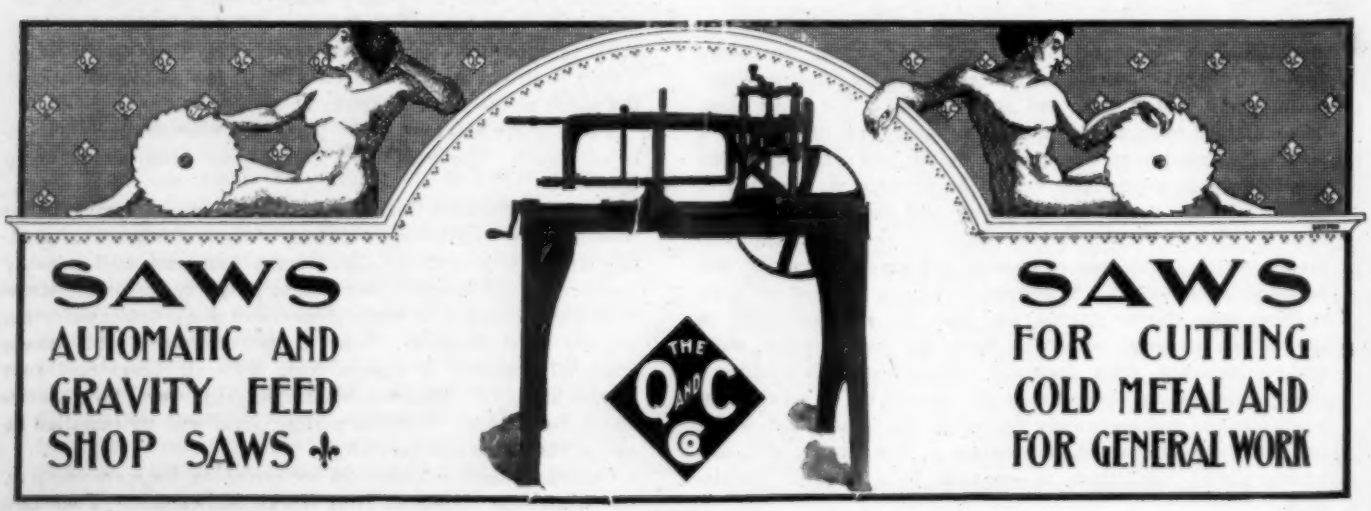
Power Equipment and Machine Tools.

The Lakeside Malleable Iron Co., of Racine, Wis., is making extensive improvements to its plant, by adding a 15-ton reverberatory furnace, two 100 h. p. boilers and a Corliss engine. This will increase the capacity from eight tons a day to about 20 tons.

The E. P. Allis Co., has the contract to build a blowing engine for the Sulin Iron & Steel Co., to be erected in the company's blast house at Sulin, on the River Don, in Russia. The engine will weigh 350 tons, and will cost $50,000. The Allis company also received orders recently for four engines for Bristol, four for London and two for Cork, all being electric generators for tramway service.

William Tod & Co., of Youngstown, O., have been awarded the contract by the National Steel Co. for a vertical steeple-cross compound blowing engine, which is to be placed at the Sharon Furnace, Sharon, Pa. The cylinders are 84 inches in diameter. It will be completed by June.

For the first time in their history the Aultman-Taylor Machinery Co., manufacturers of the Cahall horizontal and vertical water tube boilers are operating night and day, having been compelled to do this in order to take care of the steadily increasing demand for this type of boiler. The output of the first week when the plant was operated night and day was 1,500 h. p. per day, but in the second week this was increased



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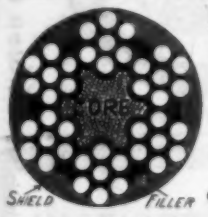

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to 1,800 h. p., and this large output will be maintained steadily until next October or later, there being sufficient orders already entered to take the entire output up to that time.

One of the three large engines which the Wm. Tod Co., engineers, founders and machinists, of Youngstown, O., are building for the Youngstown works of the National Steel Co., is about ready to be shipped. They are of the steeple, cross compound, vertical type, with steam cylinders 54 and 102 inches, 60-inch stroke, with Corliss valve gear. Each engine has two blowing cylinders 108 inches in diameter, 60-inch stroke. The fly-wheel is 70 tons in weight, 24 feet in diameter.

The Pittsburg District:—

The Union Steel Casting Co., Pittsburg, has been incorporated with $70,000 capital stock, all paid in. Mention has already been made of the concern's having started work on the erection of a steel casting plant in Pittsburg, across the Allegheny river from Etna.

The Pittsburg Steel Foundry Co., Pittsburg, has secured a charter with $250,000 capital stock. As has been stated, the concern will erect a large steel casting plant at Glassport, Pa.

The tube plant mentioned some time ago as to be built at Beaver Falls, Pa., by a party of oil men headed by H. G. Wasson, a Pittsburg attorney, is now under construction. The concern will be known as the Atlantic Tube Co., and the plant is expected to be in operation by October 1.

The Pittsburg Machine Tool Co., Pittsburg, Pa., has been incorporated with $250,000 capital stock. A plant will be erected in Allegheny City. Frank Moore, president of the Pittsburg Malleable Iron Co., is president.

A. M. Byers & Co., Pittsburg, have advanced the wages of some 300 boys employed in the pipe and tube plant by 5 per cent, in compliance with a request made Saturday, last.

The Chester Rolling Mill Co., Ferguson Building, Pittsburg, which proposes to build a 6-mill sheet plant at Chester, W. Va., opposite East Liverpool, O., has elected the following directors: J. N. and C. W. Tindle, T. B. McKnight, and Oliver Bingham, Pittsburg; William Banfield, Irondale, O.; J. E. McDonald, East Liverpool, and A. W. Webber, Iron

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dale. The officers are C. W. Tindle, president; W. N. Voegtly, secretary and treasurer, and land agent, J. E. McDonald.

It is stated that four mills are to be added to the American Tin Plate Co.'s plant at Monessen, Pa., where nine mills are now completed.

The removal of the chain works of James McKay & Co., Pittsburg, to McKees Rocks, Pa. mentioned recently, will be commenced in a sort time. Arrangements have been completed for the purchase of nine acres at that place, from the Cole estate, the land lying near the location of the works being built by the Pressed Steel Car Co. The works will be considerably enlarged in the removal.

General Industrial Notes:—

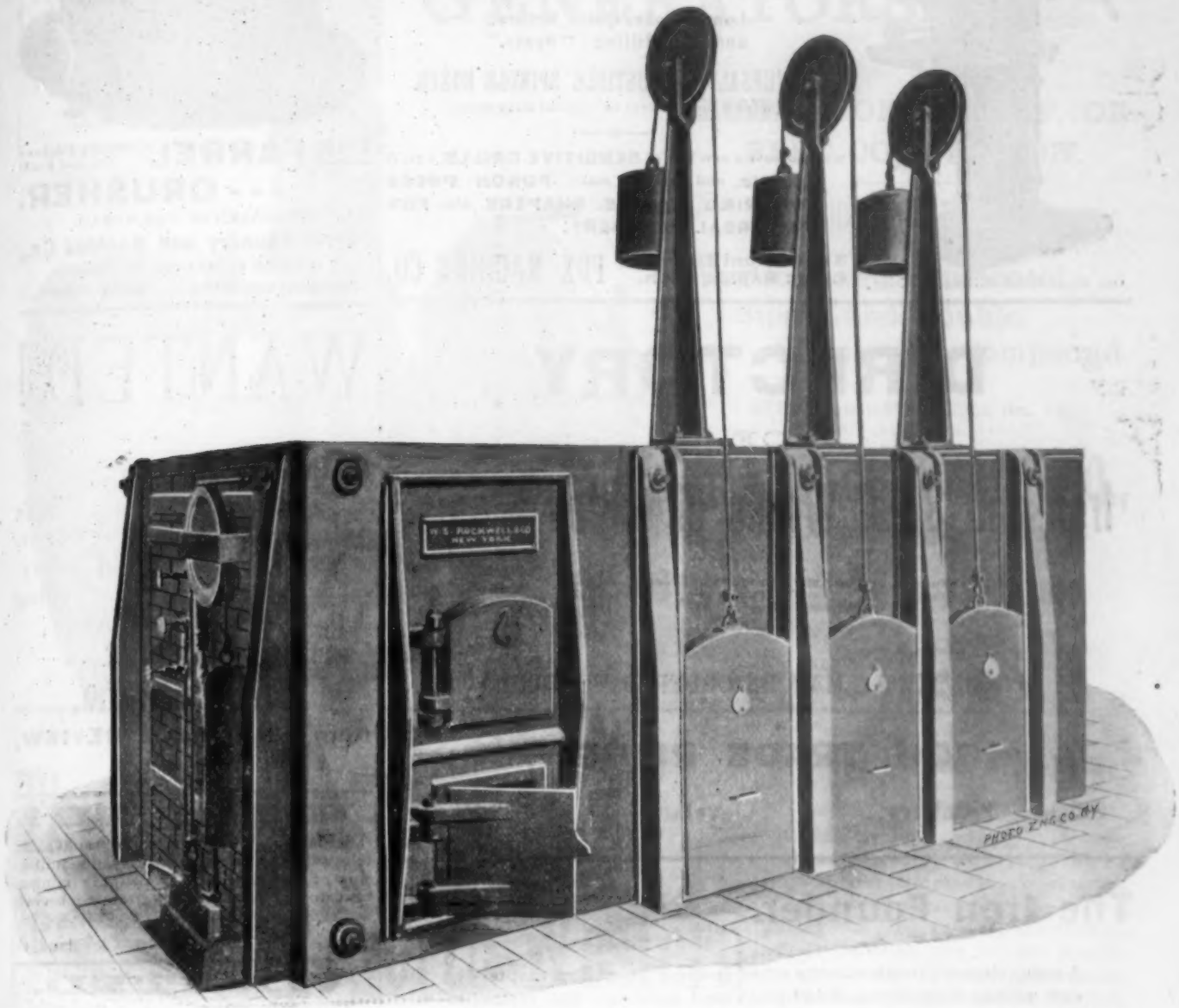
The following figures are given concerning the output of the Nova Scotia Steel Co., in 1898: The company produced in its works at Ferrona and New Glasgow, N. S., 21,627 tons of pig iron, 23,541 tons of steel, and 2,276 tons of forgings, in the manufacturing of which it consumed 107,000 tons of coal, 19,000 tons of native ore, 15,000 tons of Newfoundland ore, 6,000 tons of Spanish or Cuban ore, 32,000 tons of coke and 18,000 tons of limestone. It employed on the average 750 men and paid out in wages $280,000 during the year.

The Novelty Stamping Co., Bellaire, O., advanced wages taking effect May 1.

Puddlers at the Alan Wood Co.'s plant at Carshohocken, Pa., were given an unsolicited advance of 10 per cent on April 1. Last week they demanded a further advance and were discharged.

A Birmingham, Ala., dispatch says that a sale has been made of the Vanderbilt furnace property to Maj. E. A. Tutwiler, of the Tutwiler Coal & Iron Co., and associates. The price was $12,500. New equipment will be needed.

Metallurgical Furnaces



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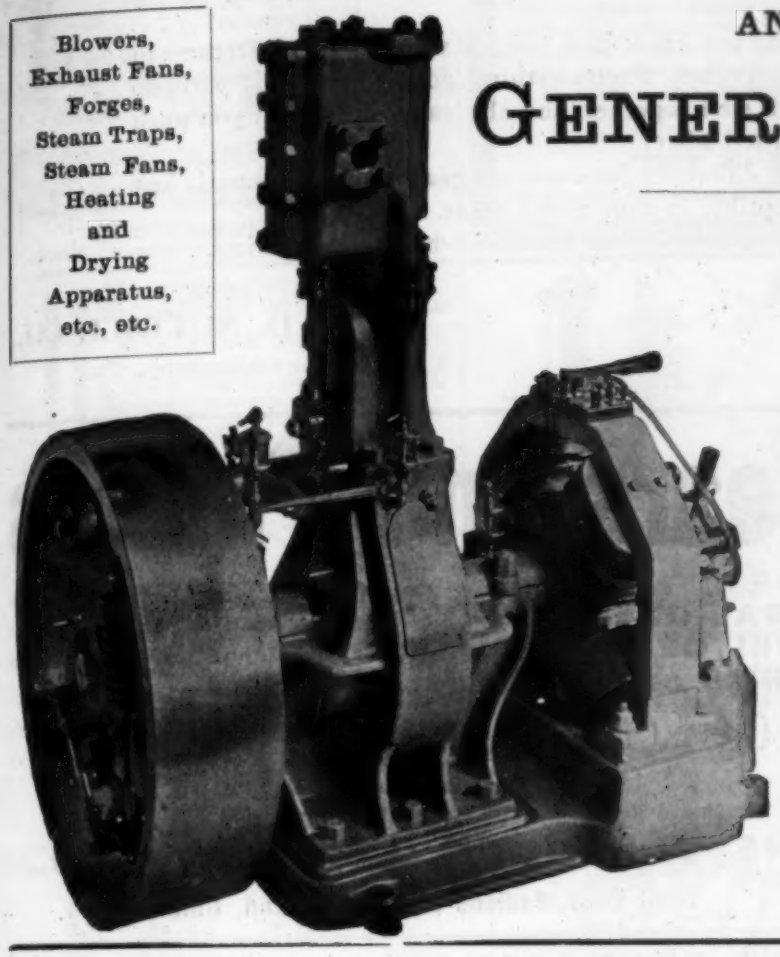

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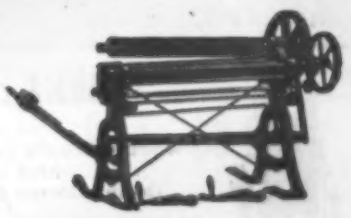

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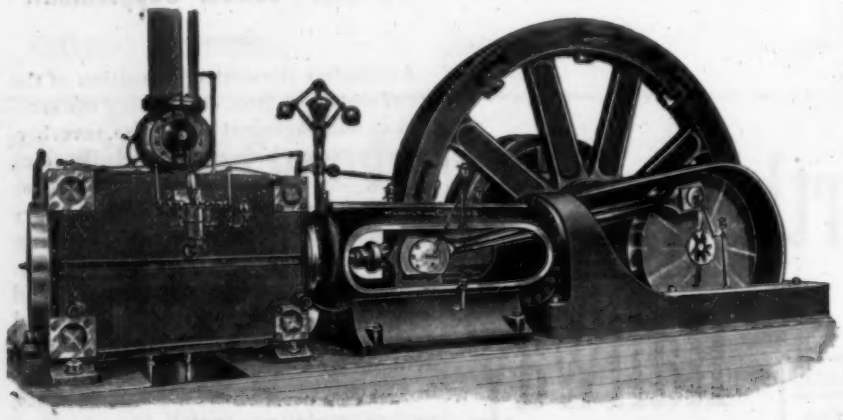

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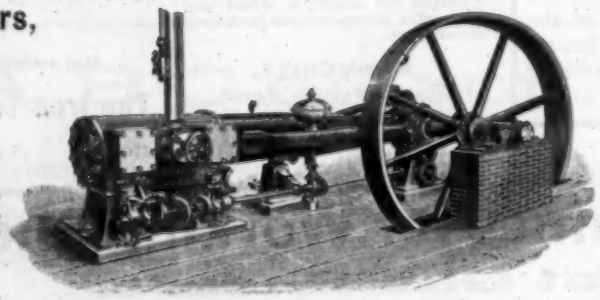

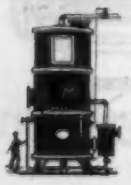

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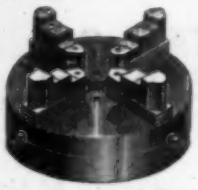

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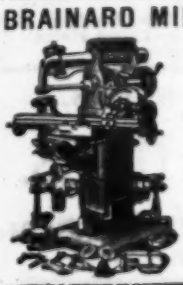

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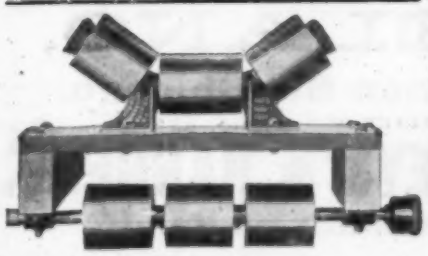

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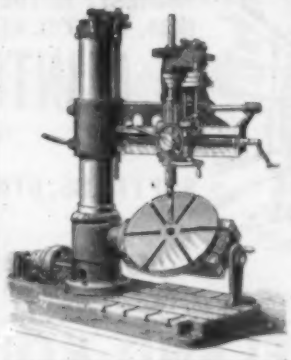

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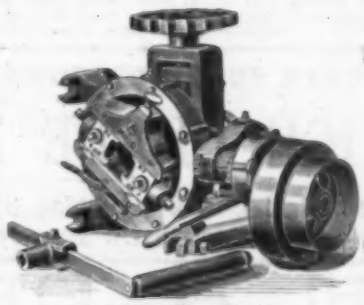

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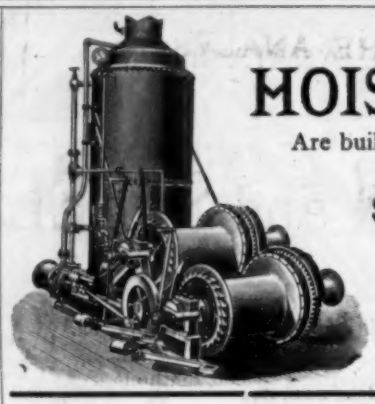

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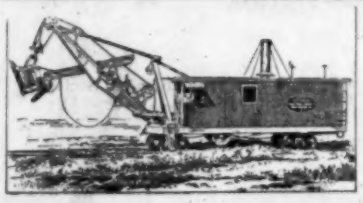

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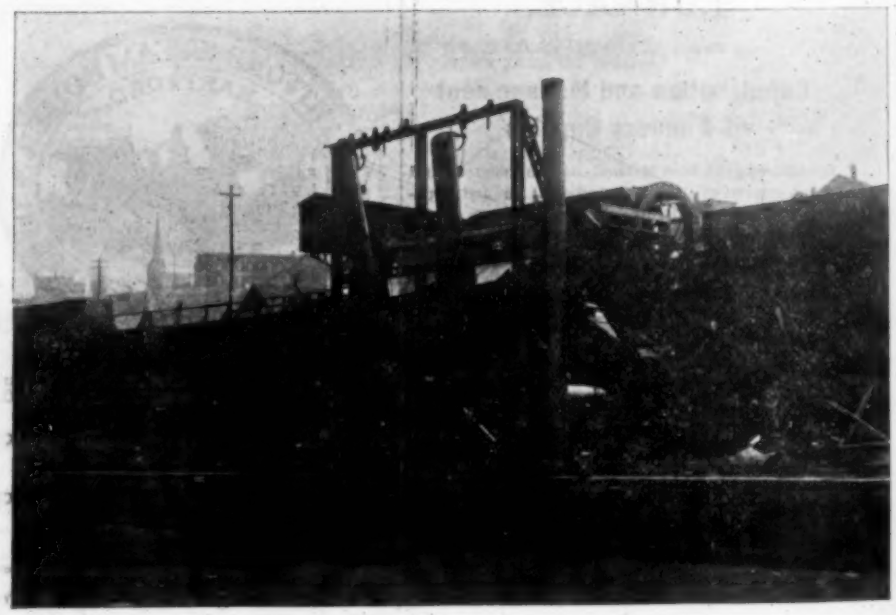

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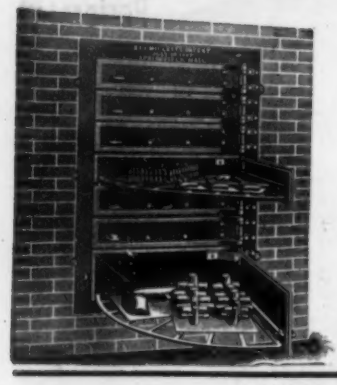

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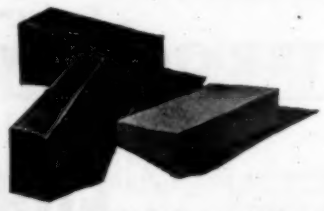

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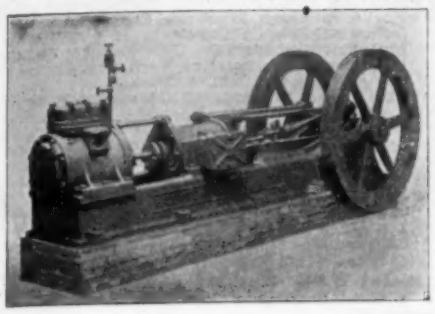

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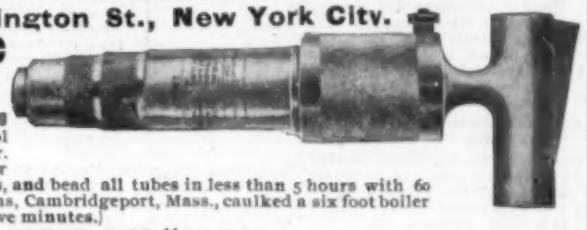

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Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Columbia Fire Clay Co., Cleveland, O.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.
Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Furnaces—
Playford Stoker Co., Cleveland, O.
Furnace Linings—
Union Mining Co., Mt. Savage, Md.
Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.
Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.
Gas Burners—
American Gas Furnace Co., New York City.
Gas Furnaces—
American Gas Furnace Co., New York City.
Gearing.
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Gum Casting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.
Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.
Gear Lubricants—
The Ironsides Company, Columbus, O.
Grease—
A. F. Boettcher, Rowlands, Pa.
Grindstones—
C. H. Besly & Co., Chicago, Ill.
Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,
Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.
Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
Brass Founders' Supply Co., Newark, N. J.
Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.
Hangers—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.
Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.
Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayto . O.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.
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Parkhurst & Wilkinson Co., Chicago, Ill.
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Earle C. Bacon, New York City.
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Jeffrey Mfg. Co., Columbus, O.
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Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
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The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Machine Co., New York City.
Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.
Hotels—
United States Hotel Co., Cleveland, O.
Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Injectors—
C. H. Besly & Co., Chicago, Ill.
Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.
Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Iron Nails and Spikes—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
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Iron and Steel Roofing—
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Perfect Lubricating Metal Co., Cincinnati, O.
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F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
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The S. Obermayer Co., Cincinnati, O.
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Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.
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C. H. Besly & Co., Chicago, Ill.
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Rob't Aitchison Per. Metal Co., Chicago, Ill.
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Packing—
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Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
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E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Hickman & Williams, Chicago, Ill.
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Salisbury Carbonate Iron Co., New York City.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
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Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering—
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Jenkins Bros., New York City.
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The Armstrong Mfg. Co., Bridgeport, Conn
Planers—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
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Clayton Air Compressor Works, New York.
Pneumatic Tools.—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
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C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
E. Konigslow & Bro. Cleveland, O.
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The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Punches—
E. Konigslow & Bro. Cleveland, O.
Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Rivets—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.
Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
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Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
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Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.
Saws—
Peter Gerlach & Co., Cleveland, O.
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Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
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Fraser & Chalmers, Chicago, Ill.
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C. H. Besly & Co., Chicago, Ill.
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Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.
Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
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Fitzsimmons & Co., Cleveland, O.
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Jones & Laughlins, Ltd., Pittsburg, Pa
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Shapers—
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Fox Machine Co., Grand Rapids, Mich.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
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Wm. Cramp & Sons, Philadelphia, Pa.
Special Machinery—
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Wheeling Mold & Foundry Co., Wheeling, W. Va.
Stand Pipes—
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Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.
Steam Packing—
C. H. Besly & Co., Chicago, Ill.
Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Steam Specialties—
C. H. Besly & Co., Chicago, Ill.
Steel—
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E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
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Ohio Steel Co., Youngstown, Ohio.
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American Tin Plate Company, Chicago, Ill.
Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
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Tool Steel—
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Bræburn Steel Co., Bræburn, Pa.
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Transmission Machinery—
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B. F. Sturtevant Co., Boston Mass.
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Wire Coating.
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Swarts Metal Refining Co	1
Tabor Mfg Co	32
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BRÆBURN STEEL COMPANY, Bræburn, Pa.
MANUFACTURERS OF
FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

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.....Almost no **STEEL EXPENSE**
NO TROUBLE
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Cleveland Warehouse, 97 Water St.

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ESTABLISHED 1865 ✻ INCORPORATED 1889.
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CRUCIBLE CAST TOOL STEEL.
SPECIAL GRADES FOR ALL PURPOSES.
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FLAT & COILED FOR STAMPING BLANKING DRAWING SPRINGS ETC
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You can now make all water pipes as secure from bursting in winter as in summer. This pneumatic system is the only one which successfully prevents the annoying and costly bursting of water pipes. It has solved a great economic problem. Highly indorsed by architects, engineers and municipal officials.

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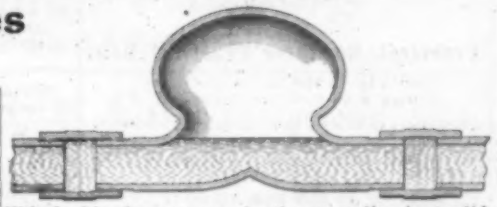

This double slope causes the expanding ice to slide into the air dome, taking the strain off the pipe. The air cushion also prevents "hammering." Covered by United States and Foreign Patents.

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Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS On Short Notice.

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Special low-phosphorus hard Ore, Bessemer	$3.75
No. 1 Specular, Bessemer	$3.15@3.50
No. 1 Bessemer hematite	2.75@3.25
Hematites No. 1 non-Bessemer	1.90@2.10
No 1. Specular, non-Bessemer	2.00@2.40
Mesabi Bessemer	1.80@2.00

PIG IRON.

CLEVELAND (l. c. h. cars):	
Bessemer	$15 15
No. 1 Strong Foundry	$15 65@16 00
No. 2 Strong Foundry	15 15@15 40
Gray Forge, red short	14 65
Gray Forge, neutral	14 40
No. 1 American Scotch	15 75@16 00
No. 2 American Scotch	15 40@15 65
Lake Superior Charcoal	16 50@17 00
PITTSBURG:	
No. 1 Foundry	$15 75@16 00
No. 2 Foundry	15 50@15 75
Gray Forge	14 75@14 50
White and Mottled	13 50
Warm Blast Charcoal	15 00@17 00
Cold Blast Charcoal	22 00@26 00
Bessemer	15 15@15 25
CHICAGO:	
Lake Superior Charcoal	$17 00@18 00
Local Coke Foundry No. 1	15 50@15 75
Local Coke Foundry No. 2	15 00@15 50
Local Coke Foundry No. 3	14 50@14 75
Local Scotch Foundry No. 1	15 50@15 75
Local Scotch Foundry No. 2	15 00@15 50
Local Scotch Foundry No. 3	14 50@14 75
Southern Coke No. 1	16 00@16 25
Southern Coke No. 2	15 25@15 75
Southern Coke No. 3	14 75@15 00
Southern No. 1 Soft	15 50@16 00
Southern No. 2 Soft	15 00@15 50
Southern Silveries	15 50@16 00
Jackson Co. Silveries	17 00@18 00
Ohio Silveries No. 1	@
Ohio Strong Softeners	15 50@16 50
Alabama Car Wheel	17 50@18 00
Malleable Bessemer	15 50@16 00
Coke Bessemer	15 50@16 00
CINCINNATI (reported by Rogers, Brown & Co.):	
Southern Coke No. 1, Foundry	$14 75@15 25
Southern Coke No. 2 and No. 1 Soft	14 25@14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@18 00
Tennessee Charcoal No 1	15 00@16 00
Jackson County Silvery No 1	16 00@16 25
Southern Coke, Gray Forge	12 75@13 00
" " Mottled	12 75@13 00
Standard Georgia Car Wheel	15 50@16 00
Lake Superior " "	15 00@16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 00
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	14 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 55
Southern Gray Forge	13 20
Tennessee Charcoal No. 1	13 75
Jackson County 8 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@16 00
Southern Car Wheel	15 25@16 25
Genuine Connellsville Coke	4 15
West Virginia Coke	4 10

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 50
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.50c
Angles	1.50c
Tees	1.50c
Universal Plates	1.80@1.90c
Sheared Plates	2.00c

MERCHANT IRON AND STEEL.
[Less than car-lots, Cleveland.]
Rounds and Squares.—Bar Iron.

1 to 1½	1.50 Base.
2 to 2½	.50 extra.
3 to 3½	.50 "
3½ to 4	.75 "
4½ to 4¾	1.00 "
4¾ to 5	1.50 "
5½ to 6	1.00 "
5¾ to 6½	2.00 "

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All standard and special grades.
In sectional molds or bars.

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Wrtte us for prices always. It will pay you.

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A Practical Book for Practical Men.

Should be in the hands of every mining man and metallurgist.

All previous works on gold metallurgy have devoted most attention to the theories, mechanics, chemistry and history of gold milling. This book tells

WHAT TO DO AND HOW TO DO IT.

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The articles, from which this book is compiled, first appeared in our columns, where they secured widespread interest. We have undertaken its publication at the suggestion of prominent men in the mining world, who wished to have the valuable information therein contained in more permanent form.

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218 La Salle Street,

CHICAGO, U. S. A.

6⅝ to 7¼	2.50 extra
⅝ to ⅞	.10 "
⅝ to 11-16	.30 "
⅝ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to 1 32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1¾ o 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1¼	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅜ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
⅝ to 15-16 x ⅜ to ⅝	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
¼ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30
¼ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. Bevel Edge Shaft Iron 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¾ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes o Light Bands.

Oval Iron.

⅜ to 1¼	.40 extra
⅜ to 13-16	.50 "
⅜ to 11-16	.60 "
⅜ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
½ to 11-16 x ⅜	1.20 "

Half Oval and Half Round.

2¾ to 3	.60 extra
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅞ to 11-16	.90 "
¼ to 9-16	1.20 "
¼ to 7-16	3.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

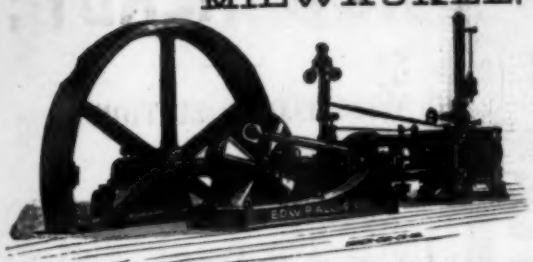
Width In Inches.	English Standard Gauge.		Extras.
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16	1.50	Base.
1¼ to 6,	" 10, 11, 12 or ¼"	.05	per 100 lbs.
1 to 1¾,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¾,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼",	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-19	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ¼"	1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		Extras.
7-16 to 3	Nos. 13, 14, 15 and 16	1.60	Base
7-16 to 2,	" 17, 18, and 19	.05	per 100 lb.
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
⅛ to 1¾,	" 13, 14 and 15	.05	"
⅛ to 1¾,	" 16, 17 and 18	.10	"

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



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Southwark Foundry & Machine Co.

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Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

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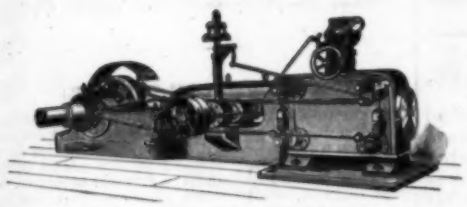
CINCINNATI, OHIO.



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Simple and Compound.

Shafting, Hangers, Pulleys.

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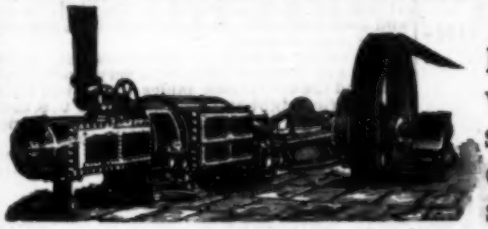

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We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.
We make also the

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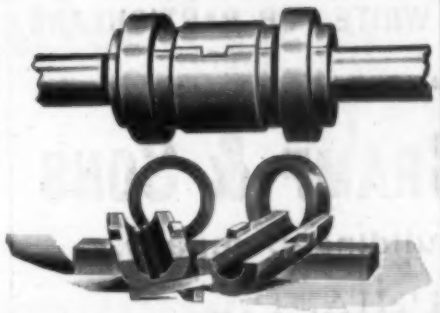
Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

1⅛ to 1¼,	"	19 and 20	per 100 lbs.
1⅛ to 1¼,	"	21	.20 "
1⅛ to 1¼,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	"
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos. 13, 14 and 15		.20 "
⅞,	" 16, 17 and 18		.25 "
⅞,	" 19 and 20		.30 "
⅞,	" 21		.35 "
⅞,	" 22		.45 "
¾ and 13-16	Nos. 13, 14 and 15		.30 "
¾ and 13-16	" 16, 17 and 18		.35 "
¾ and 13-16	" 19 and 20		.40 "
¾ and 13-16	" 21		.45 "
¾ and 13-16	" 22		.50 "
¾ and 13-16	" 23		.60 "
11-16,	Nos. 13, 14 and 15		.35 "
11-16,	" 16, 17 and 18		.40 "
11-16,	" 19 and 20		.50 "
11-16,	" 21		.60 "
11-16,	" 22		.70 "
11-16,	" 23		.80 "
⅝,	Nos. 13, 14 and 15		.40 "
⅝,	" 16, 17 and 18		.45 "
⅝,	" 19 and 20		.55 "
⅝,	" 21		.65 "
⅝,	" 23		.75 "
⅝,	" 23		.85 "
9-16,	" 13, 14 and 15		.45 "
9-16,	" 16, 17 and 18		.50 "
9-16,	" 19 and 20		.60 "
9-16,	" 21		.70 "
9-16,	" 22		.80 "
9-16,	" 23		.90 "
½,	" 13, 14 and 15		.55 "
½,	" 16, 17 and 18		.60 "
½,	" 19 and 20		.70 "
½,	" 21		.80 "
½,	" 22		.90 "
½,	" 23		1.00 "
7-16,	" 13, 14 and 15		.80 "
7-16,	" 16, 17 and 18		.90 "
7-16,	" 19 and 20		1.00 "
⅜,	" 13, 14 and 15		1.00 "
⅜,	" 16, 17 and 18		1.10 "
⅜,	" 19 and 20		1.20 "

Sheet Iron.

No. 10	2 25
No. 12	2 85
No. 14	3 30
No. 15-17	2 40
No. 18	2 50
No. 20	2 70
No. 22-24	2 70
No. 25-26	2 80
No. 27	2 90

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 40
Flange	2 60
Marine Flange	2 75
Fire Box	3c to 3½

Above includes plates 90 inches wide.

90 to 96 in. wide	1c. lb. extra
96 to 100 in. wide	1½c. "
100 to 104 in. wide	2c. "
104 to 106 in. wide	special.

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 25
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 60

Wrought Pipe and Boiler Tubes.

Merchant pipe, from store....dis. 60 and three 10s

Boiler tubes, 1¼ to 1½ inch...	Discount	45
" " 1¾ to 2¼ inch iron,	"	55
" " " " steel,	"	60
" " 2¾ to 4 inch, iron,	"	60
" " " " steel,	"	62½
Casing, screw and socket joint	"	50
Casing, inserted joint	"	45

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The Popular Line.

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Indianapolis,
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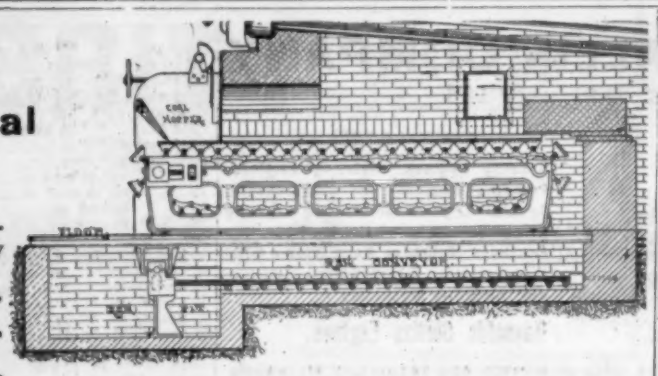
The A B C of Iron,

NOW $1.00.

The Playford Mechanical Stoker



Guaranteed to Abolish smoke, to increase boiler capacity and to save fuel.

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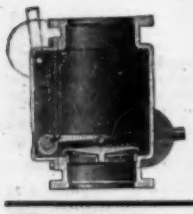
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.



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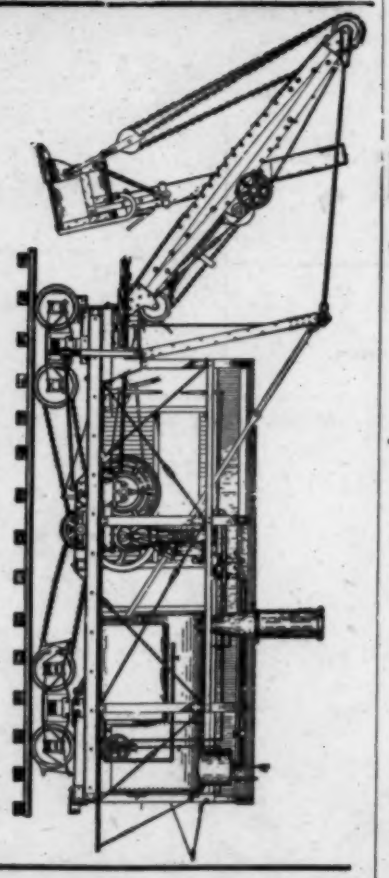

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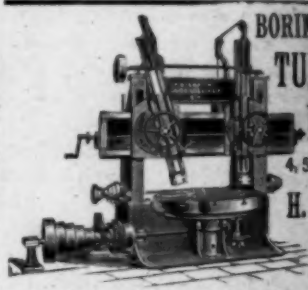

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